

OCT 28 1993

RESTORING AND PROTECTING THE GREAT LAKES

 *Progress report from 1991*

 **Ontario**

Ministry of Environment and Energy
Ministry of Natural Resources
Ministry of Agriculture and Food

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1 Introduction

Canada and the United States share one of the world's greatest natural treasures — the Great Lakes system. Lakes Erie, Huron, Michigan, Ontario and Superior together represent one-fifth of the world's fresh water supply and offer a wealth of economic, recreational and life-sustaining benefits to those who live along their shores.

A shared responsibility to protect the Great Lakes was first recognized some 84 years ago when Canada and the United States signed the Boundary Water Treaty, essentially a promise not to pollute each other's waters. The International Joint Commission was then formed to ensure that both countries lived up to the terms of the treaty.

Decades of neglect and abuse, however, have taken their toll on the Great Lakes and their interconnecting channels. While improvements have been made in some areas, serious problems remain.

The Canada-U.S. Great Lakes Water Quality Agreement, signed in 1972 and amended in 1978 and 1987, serves as the principle vehicle for ensuring a co-ordinated, binational approach to solving these problems.

ONTARIO'S COMMITMENT TO RESTORE AND PROTECT THE GREAT LAKES

Ontario, the only Canadian province bordering the Great Lakes, plays an important role in Canada's response to the Great Lakes Water Quality Agreement. This report, prepared for the October 1993 meeting of the International Joint Commission, outlines the progress of Ontario's initiatives during the past two years to restore and protect the Great Lakes and their interconnecting channels.

Ontario has demonstrated its willingness to work co-operatively with other governments and interested groups or people to address Canada's obligations under the Great Lakes Water Quality Agreement.

In recent years, MOEE alone has spent more than \$150 million per year, through various programs, to restore and protect the Great Lakes.

REGULATION AND PREVENTION

During the past 20 years the Ontario Ministry of Environment and Energy (MOEE), has relied on the regulatory approach to control contaminant emissions to air, water and land. Bottom-of-the-stack or end-of-pipe controls technologies and contaminant dilution were encouraged to reduce pollution. If such control mechanisms were designed, constructed and operated at the best possible level, they were capable of keeping concentrations of contaminants in a single medium at satisfactory levels in the environment. However, the costs of constructing and operating such systems are high and increasing, at a time when demands for capital for other purposes are substantial.

Although the regulatory approach has provided an essential first line of defence in combatting pollution, it is MOEE's view that this approach will neither fulfil its current cleanup and protection commitments within the Great Lakes basin, nor the current and future needs of the global ecosystem. To maintain the quality of the environment, the ministry's environmental programs will be based increasingly on measures which are oriented towards pollution prevention rather than pollution control. MOEE has defined pollution prevention as any action which reduces or eliminates the creation of pollutants or wastes (toxics, hazardous and non-

hazardous wastes) at their sources, and includes the principle of conservation of natural resources. It can be achieved through:

- substitution or reduction in use of raw material
- product redesign
- process changes
- in-process recycling and improved maintenance and operating procedures

Pollution prevention is not a radically new approach to environmental management. It has been used successfully in the past in a number of environmental initiatives. One such initiative was the decision in the early seventies by detergent manufacturers to phase out the use of phosphorus in their product. More recently pollution prevention has become the ministry's preferred approach in the effort to reduce our municipal solid wastes. However, its use on an issue by issue basis or on a single medium basis is not enough. In the future, pollution prevention principles will be applied consistently to all MOEE program areas and across all media - air, water and land.

The ministry has made pollution prevention a priority in the management of pollution in the 90s. MOEE created its Pollution Prevention Office in May 1992 to act on the government's commitment to pollution prevention through business partnerships, planning, training, outreach and information sharing. MOEE's

challenge in the immediate future is to redirect the thrust of its existing Great Lakes programs and to design new initiatives to help industries, businesses, individuals and institutions implement pollution prevention.

MOEE's pollution prevention program is described in Part II of this report, as one of the ministry's core environmental programs to combat pollution to the Great Lakes. The municipal-industrial strategy for abatement, water and sewage treatment, and the remedial action plan program are also highlighted.

There are several other programs undertaken by the ministry which supplement the resources and effort invested in the core programs. These are described in Part III of the report.

The Ontario Ministry of Natural Resources (MNR), and the Ontario Ministry of Agriculture and Food (OMAF) also contribute substantially to Ontario's investment in the protection and restoration of the Great Lakes. Current activities by both MNR and OMAF, described in Part IV, reflect the move towards more sustainable development. The successful implementation of the initiatives of these agencies will translate into improved benefits for the Great Lakes basin ecosystem.

MOEE is also an active participant in a number of binational activities, in support of Canada, which are described in Part V.

II Principal initiatives

■ *Municipal-industrial strategy for abatement (MISA)*

■ *Water and sewage treatment*

■ *Remedial action plans (RAPs)*

■ *Pollution prevention*

■ MUNICIPAL - INDUSTRIAL STRATEGY FOR ABATEMENT (MISA)

The Ministry of the Environment and Energy (MOEE) established the municipal-industrial strategy for abatement (MISA) in 1986 to control pollution in Ontario's lakes and rivers. The goal of this regulatory program is to eliminate the discharge of persistent toxic contaminants into the province's waterways. Major polluters covered by the program include approximately 300 direct discharging industries in nine major industrial sectors and about 400 municipal sewage treatment works. The nine industrial sectors are: petroleum refining, organic chemicals, iron and steel, inorganic chemicals, pulp and paper, mining, metal casting, electric power and industrial minerals. The MISA program has two phases: contaminant data collection or effluent monitoring and development of legally enforceable regulations on effluent limits.

The environmental benefits of the MISA clean water regulations will be reduced concentrations of toxic chemicals in open waters and bottom sediments, reduced levels of contaminants in fish and fish-eating birds, and reduced health risks for people who use the Great Lakes for recreation and as a source of drinking water and food.

MISA direct industrial dischargers

- As of July 1992, all nine industrial sectors had met the requirements for effluent monitoring (MISA monitoring regulations).

Dischargers were required to self-monitor their effluents for a 12-month period, at regular intervals, according to MOEE standards. MOEE also made regular audits of all sectors. During the 12-month monitoring period, all effluents were monitored for acute lethality to rainbow trout and *Daphnia magna* (water flea); all effluent limit regulations include the condition that the final effluent must not kill aquatic life, as measured by such a standardized scientific test. The results of the monitoring are being published as they become available.

- On Sept. 10, 1993, the Effluent Limits Regulation for the petroleum refining sector became law. The regulation applies to seven petroleum refineries, all of which discharge into the Great Lakes or its tributaries. It is estimated that by January 1, 1996, the regulation will reduce contaminant discharges from petroleum refineries by 30 per cent. This includes the elimination each year from the industry's effluent of 300,000 kilograms of conventional pollutants such as oils and total suspended solids, and 4,400 kilograms of toxic metals and organic chemicals.
- On Feb. 2, 1993, the draft effluent limits regulation for the pulp and paper sector was released for public review and comment. The regulation, which proposes a goal of zero discharge of organochlorines by the year 2002, affects 26 pulp and paper mills in Ontario. Pulp and paper mills are responsible for 90 per cent of the organochlorines directly discharged to our waterways.

Some chlorinated organic chemicals are persistent in the environment and can accumulate in living organisms.

- On Sept. 13, 1993, the draft effluent limits regulation for the metal mining sector was released for public review and comment. The regulation will affect 32 mines and refineries in Ontario that produce base metals such as nickel, zinc, iron and gold. The regulation will reduce by 40 per cent discharges of copper, lead, nickel, zinc, cyanide and arsenic and reduce total suspended solids by 23 per cent. Reductions in regulated contaminants should lead to reductions in other substances such as aluminium, chromium, cobalt and iron.
- The next draft regulations to be released in 1993 are for the metal casting and industrial minerals sectors.

MISA sewer use control program/sewage treatment plants (STPs)

The more than 400 municipal sewage treatment plants in Ontario process an average of six million cubic metres of wastewater a day, enough to fill the Toronto SkyDome one-and-a-half times every day. This volume includes sanitary waste from approximately four million households and chemical waste from more than 12,000 industrial establishments. Almost one-third of the wastewater received by sewage treatment plants is created by industry.

Most of the metal and organic toxic compounds found in sewage come

from industrial effluents. Industrial sewage poses problems for the environment and for the effective operation of a sewage treatment plant, including such complications as the pass-through of toxic pollutants, interference with STP operations and sludge contamination.

In 1988, MOEE initiated the development of the sewer use control regulation. Under this proposed regulation, municipalities would be required to undertake new responsibilities for monitoring and regulating discharges to municipal sewers.

The projects that have been undertaken because of this initiative have provided MOEE with hands-on experience which should accelerate the development of the sewer use control regulation and provide an efficient implementation plan. The results have demonstrated the need to implement household and commercial initiatives focusing on pollution prevention programs if pollutant loads to STPs are to be reduced significantly.

To date, the following results have been achieved through the development of the sewer use control regulation:

- More than 80 municipalities have passed sewer use bylaws to deal with industrial effluents that discharge to the municipal sewage treatment plant. These bylaws limit the amount of pollutant concentrations that may enter the sewer.
- Five municipal sewer use demonstration projects (Cobourg, Gananoque, Hamilton-Wentworth, Ingersoll and Thunder Bay), initiated in 1990, were

completed in March 1992. The limits for the amounts of pollutants discharged to each STP have been determined, based on field data. Pollutant loads have been calculated for each major industry discharging to the sewer system. Bylaw enforcement and targeted sampling programs are tools used to reduce industrial loadings.

- During 1991 and 1992, MOEE initiated the development of two additional courses as a component of the sewer use training program for municipal enforcement staff: a hands-on sampling course, and a course in sewer use control data collection and archiving. In total, five courses have been developed and implemented to support the MISA municipal program. This will improve efficiency and help to ensure that bylaws and discharge limits are met. At the end of 1992, more than 400 municipal staff had taken at least one of the five courses.
- A study with Metropolitan Toronto was initiated to determine which industry sectors or industries need best management practices (BMP) plans and the best methods for implementing and enforcing these plans. Particular emphasis was placed on discharges to the sewers from automotive servicing, runoff from industrial sites, and chemical storage spills. During 1992, work continued on developing a draft BMP for service stations. These BMPs could be released by the end of 1993.

WATER AND SEWAGE TREATMENT

Infrastructure funding

To ensure that water and sewage treatment plants are performing at an adequate level of treatment, MOEE provides funding assistance for upgrading and expansion.

- MOEE previously has provided grants to municipalities based on priority, population and availability of funds. Under the granting program, the ministry has provided the following assistance to Ontario municipalities in the Great Lakes watershed for infrastructure upgrades, expansion and optimization in recent years:

YEAR	TOTAL \$MILLIONS	SEWAGE	WATER
1990/91	\$180.2 M	\$110.8 M	\$69.4 M
1991/92	\$185.9 M	\$116.2 M	\$69.7 M
1992/93	\$172.4 M	\$110.2 M	\$62.2 M
Total \$	\$538.5 M	\$337.2 M	\$201.3 M

- During 1991 and 1992, construction was begun on five of the 28 remaining primary sewage treatment plants in the province to upgrade them to secondary treatment. The five plants are the Robert O. Pichard Environmental Centre (Gloucester), Point Edward (Point Edward), Kemptville (Kemptville), Port Dover (Nanticoke), and Smiths Falls (Smiths Falls). During 1993, the town of Espanola began construction to upgrade its primary plant to secondary treatment. Four additional primary plants are currently conducting environmental assessments for future upgrades.

- On Feb. 11, 1993, Premier Bob Rae announced the investment of \$258 million by the jobs Ontario capital program for the upgrading and construction of new sewer and water facilities throughout Ontario. Of the \$258 million, more than \$90 million will be spent in 1993-94 in support of 120 projects. With municipal and third party (private sector) participation, it is estimated that more than \$400 million will be spent during the next four years.

Ontario Clean Water Agency

In recognition of the need for continued support for water and sewage services, the Premier announced the creation of the Ontario Clean Water

Agency on Feb. 9, 1993. The agency, which will report to the Minister of Environment and Energy, is dedicated to investment in the development of water and sewer infrastructure. It will operate municipally and provincially-owned sewer and water facilities; assist municipalities in expanding and upgrading their water and sewage facilities for the protection of human health and the environment; encourage water conservation by promoting the efficient use of existing facilities; and support provincial land use planning and growth objectives.

- In August 1993, Minister of Environment and Energy Bud Wild-

man announced a new municipal assistance program supporting the planning and delivery of environmentally sound, efficient, and cost-effective water and sewage services throughout Ontario. Under the new program, a greater variety of types of projects will be funded by the province, including major components of the systems, water efficiency and system optimization studies and their capital projects, and combined sewer overflow and stormwater control projects.

Performance: Operation of direct industrial dischargers and sewage treatment plants

The 1978 Canada-U.S. Great Lakes Water Quality Agreement requires that the parties prepare an annual report on abatement progress and status of compliance with monitoring and effluent restrictions. Ontario prepares two annual reports: the *Report on the Industrial Direct Discharges in Ontario* and the *Report on the Discharges from Sewage Treatment Plants in Ontario*. These reports contain comprehensive summaries of industries' and municipalities' performance in controlling the quality of discharges into Ontario's waterways. They detail compliance with effluent requirements. A single example of any effluent criteria being exceeded during the year puts the discharger into the non-compliance category. Generally, the reports are released one to one-and-a-half years after the end of each calendar year.

- In 1990, 76 per cent of sewage treatment plants (STPs) were in complete compliance in Ontario,

up from 70 per cent in 1989. The primary reason for the improvement was the compliance rate for total phosphorus which rose from 70 per cent in 1989 to 86 per cent in 1990; compliance rates for BOD and TSS remained relatively constant for both years.

- Fifty-one per cent of 137 industrial dischargers reported in the Ontario portion of the Great Lakes basin met all their site-specific requirements or guidelines in 1990 at all times; an increase from 48 per cent of 138 sources reported in 1989.
- In 1990, industrial sources met their individual effluent criteria limits 90.3 per cent of the times that they were monitored, up from 88 per cent in 1989.

REMEDIAL ACTION PLANS

Program status

The remedial action plan (RAP) program is a joint effort led by the governments of Ontario and Canada to restore water quality and impaired uses at the 17 areas of concern (AOCs) in the Canadian waters of the Great Lakes Basin. The Ontario RAP program is part of an international cleanup initiative under the Canada-U.S. Great Lakes Water Quality Agreement addressing a total of 43 areas of concern on the Great Lakes.

The province of Ontario has played a lead role in the RAP program since 1987. As the lead ministry for provincial participation, MOEE has placed high priority on the RAP program and has consistently allocated human and financial resources to keep the Ontario RAPs at the forefront of efforts around the Great Lakes.

- Since 1987, MOEE has contributed more than \$15 million in enhanced funding to the RAP program.
- Ontario, through MOEE and the Ministry of Natural Resources (MNR), is providing staff resources to lead the development of 15 of the 17 Ontario RAP sites. The two remaining RAP areas are led by Environment Canada.
- Through its capital grants programs, Ontario has invested more than \$25 million annually in improvements to municipal sewage infrastructure in RAP areas. More recently through the jobsOntario capital program, Ontario has broadened its investment to include habitat restoration and agricultural pollution control.
- In addition to capital investment, MOEE supports RAPs through a wide range of activities including

technical assistance for improvement in sewage plant performance, environmental monitoring and impact modelling, technology development, public education and awareness, abatement and enforcement of discharge limits and a program of advice and recognition for pollution prevention.

MNR has contributed significantly to the RAP program during the last two years in providing improved funding (\$3 million) and technical expertise for the implementation of aquatic habitat protection and rehabilitation projects in the AOCs. The RAP program approach is consistent with MNR's objectives of protection and rehabilitation for the aquatic ecosystem in its Strategic Plan for Ontario Fisheries and with the MNR strategic direction of sustainable development.

- The Ontario Ministry of Agriculture and Food (OMAF) has provided staff resources to the RAP program where agriculture is a significant component of the RAP area. OMAF has also provided technical expertise to the program through its computerized georeference data base or Geographic Information System.

All but two of the 17 RAP teams have submitted Stage I reports to the International Joint Commission (IJC) describing environmental conditions and pollution sources. The remaining two are scheduled to submit their Stage I reports in 1993. Four Stage II reports, itemizing recommended actions for cleanup and timeframes, have been submitted to the Canadian federal and provincial governments, with a further one expected by the end of 1993 and the remainder by 1995.

For those RAPs that have completed Stage II reports, implementation is proceeding on a wide range of activities, in many instances on multi-year projects. This level of action is evidence of continuing commitment to the program by the province of Ontario and other stakeholders.

Although not all RAP teams have completed Stage II reports, implementation activities have now commenced in most areas. Selected highlights of restoration and rehabilitation activities are shown in Appendix II.

The IJC, in its reviews to date of Ontario RAPs, has found the Ontario process to be technically sound, thorough, and exemplary in terms of public involvement.

TIMETABLE OF CANADA-ONTARIO RAP PROGRAM

Stage I and II report submissions

AREA OF CONCERN	SUBMISSION OF STAGE I TO IJC	SUBMISSION OF STAGE II TO CANADIAN GOVERNMENTS
Thunder Bay	October 1991*	1994
Nipigon Bay	October 1991*	1994
Jackfish Bay	October 1991*	1994
Peninsula Harbour	October 1991*	1994
Spanish Harbour	October 1993	1994
Severn Sound	May 1989*	April 1993*
Collingwood Harbour	May 1989*	August 1992*
Wheatley Harbour	December 1993	1994
Hamilton Harbour	April 1989*	February 1993*
Metropolitan Toronto and Region	February 1990*	1993
Port Hope Harbour	January 1990*	1994
Bay of Quinte	October 1990*	September 1993*
St. Marys River	May 1992*	1995
St. Clair River	January 1992*	1995
Detroit River	June 1991*	1995
Niagara River	September 1993*	1994
St. Lawrence River	August 1992*	1994

* Submitted as of September 30, 1993

POLLUTION PREVENTION

Pollution prevention is any action which reduces or eliminates the creation of pollutants or wastes (toxics, hazardous and non-hazardous wastes) at their sources. It can be achieved through:

- substitution or reduction in the use of raw material;
- product redesign;
- process changes;
- in-process recycling;

- improved maintenance and operating procedures.

In this context, the challenge for the province in the immediate future is to redirect the thrust of its existing programs and to design new initiatives to help industries, businesses, individuals and institutions implement pollution prevention.

- MOEE created a Pollution Prevention Office (PPO) in May 1992 to act on the government's commitment to pollution prevention through business partnerships;

planning, training, and information sharing. The ministry's current pollution prevention activities are centred around two types of initiatives:

- development of programs featuring pollution prevention, which are designed to encourage voluntary reductions both in releases to the environment and in the generation of hazardous wastes;
- reorganization and reorientation of existing programs to incorporate pollution prevention measures.

Pollution prevention pledge program (P4)

MOEE acknowledges that many companies and government-run operations already are achieving significant reductions in emissions as part of their long-term business planning cycles. To highlight and recognize their achievements and to advertise the effectiveness of voluntary pollution prevention initiatives, the PPO has devised the pollution prevention pledge program. Under this program, the ministry will challenge companies to reduce their emissions to the environment, with special emphasis on measures oriented towards pollution prevention. In return the ministry will publicly acknowledge their achievements.

The proposed program has four levels (P1-4) of participation and achievement for facilities or sites:

- a registration/ planning level (P1);
- a reduction commitment level (P2);
- a reduction achievement level (P3);
- a pollution prevention achievement level (P4).

Interim targets of 50 per cent reductions by 1995 and 90 per cent reductions by 2000, based on 1990 emissions, have already been set for some of the most persistent toxic and bioaccumulative chemicals.

Voluntary pollution prevention planning partnerships

In addition to the pollution prevention pledge program, the ministry is actively involved in developing voluntary pollution prevention planning partnerships with a number of industry associations and some of their member companies. The bases for these partnerships are memoranda of understanding centred around the concepts of the integration of pollution prevention into business plans and cycles and the government's priority setting processes. In addition to their participation in such voluntary partnerships, industrial groups will contribute to the development of such items as:

- the design and direction of future regulatory and program initiatives, taking into account the approaches and progress of activities established under the memoranda;
- innovative economic instruments that promote and support activities oriented towards pollution prevention.

They will have access to:

- government assistance in identifying and implementing prevention oriented measures;
- ministry recognition of their activities and accomplishments; (programs under partnerships will be eligible for awards being given

through the pollution prevention pledge program).

To date the ministry, in association with Environment Canada, has initiated several pollution prevention planning partnerships with industry:

- the Motor Vehicle Manufacturers' Association/GM/Ford and Chrysler was announced in May 1992;
- a joint memorandum of understanding with the Metal Finishers' industry and Automotive Parts Manufacturers' Association was announced in June, 1993;
- a separate memorandum of understanding also is being developed with the Automotive Parts Manufacturers' Association;
- MOEE is involved in discussions with the Canadian Chemical Producers' Association, designed to achieve a similar partnership agreement within that industrial sector.

Incorporating pollution prevention in existing activities

The ministry is currently reviewing its existing programs and incorporating pollution prevention principles wherever possible. There have been a number of examples to date:

- In April 1992, MOEE's hazardous contaminants branch released a report entitled *Candidate Substances*

List for Bans or Phase-Outs (sometimes referred to as the Toxic 21); a list of 21 substances present in or discharged to the Ontario environment which, out of more than 1,000 substances assessed, are considered to be most inherently hazardous due to their persistence in water, sediment or soil, their potential to bioaccumulate and their toxicity. It was recommended that these substances be given top priority when considering candidate substances for banning, phasing out (sunsetting), or use/release reduction. MOEE is developing an expanded list which includes 27 substances, for release this year.

- MOEE supplied its Toxic 21 list to Environment Canada, as part of Ontario's contribution to the ARET (Accelerated Reduction/Elimination of Toxics) initiative, a process involving a national committee of many stakeholders, which was established in February 1992 to develop and implement a framework for the reduction or elimination of toxics. Ontario's substance evaluation and selection methodology and the Toxic 21 subsequently became the model for the selection protocol now being finalized by the ARET committee.
- The theme for MOEE's annual Technology Transfer Conference held on November 5-6, 1992 was pollution prevention. A half-day, hands-on, interactive workshop on

pollution prevention planning was held with an audience of more than 60 attendees representing industry, government, and consulting companies. At the workshop, MOEE unveiled a draft of its March 1993 Pollution Prevention Planning Guidance Document and Workbook. In addition, then-minister Ruth Grier announced MOEE's pollution prevention strategy and pollution prevention pledge program and presented an honorary pollution prevention award to Essex Specialty Products Canada (an automotive adhesives manufacturer). A similar format is planned for the conference in upcoming years.

- The PPO participated in the Lake Superior project, undertaken by the Council of Great Lakes Governors, entitled: Building technical assistance capacity within the basin to advance pollution prevention practices among small and mid-sized companies. MOEE assisted with the project design, identified relevant companies on the north shore of Lake Superior, assumed a leadership role for the Thunder Bay focus group and assisted with the preparation of the final study report.
- The PPO, in cooperation with the University of Tennessee's Centre for Industrial Services and the Ontario Environmental Training Consortium (which represents 21 Ontario community colleges), is

developing a pollution prevention training curriculum for use within MOEE, colleges and universities.

- The PPO and MOEE's water resources branch sponsored a four-day intensive pollution prevention planning and waste reduction training workshop on July 6-9, 1993. Cam Metcalf from the University of Tennessee presented course materials to a group of 40, representing staff from MOEE, the Consulting Engineers of Ontario, Ontario Waste Management Corporation, the Ontario Environmental Training Consortium and six small industrial sites from the Peel Region. As well as attending the workshop, the six industrial representatives provided plant tours to allow other workshop participants the opportunity to apply their new knowledge and insights by suggesting possible cost savings based on waste reduction and pollution prevention principles.
- MOEE's Green Industry Office, in a cooperative venture with Ministry of Economic Development and Trade, Ministry of Natural Resources, Ontario Hydro and ministries with sector responsibilities (e.g. Ontario Ministry of Agriculture and Food), has launched the Green Industry Analysis and Retrofit and Green Communities Initiative (home environmental assessment).

- The Green Industry Analysis and Retrofit offers Ontario companies comprehensive green analyses to help them use energy and water more efficiently, and to prevent, reduce and recycle waste, liquid and gaseous emissions.
- The Green Communities Initiative is a home assessment program which will supply householders in selected communities with status reports, free installation of a tune-up package, advice on recommended actions, facilitation of financing/contractor connections and an information package. More than 25 communities have been targeted under this four-year, \$40 million community-based project, including south Riverdale (Toronto), Thunder Bay, Sarnia, Hamilton, Port Hope and Cornwall.
- The ministry is reviewing existing environmental legislation in an

effort to incorporate pollution prevention principles.

- In the municipal-industrial strategy for abatement (MISA) program a number of innovative process changes and raw material substitutions have been identified in searches for best available technologies. The concepts and principles of pollution prevention are being incorporated into several regulatory and restoration programs, e.g. the clean up rural beaches (CURB) program, Lake Superior binational program, remedial action plan program, and lakewide management plans. Preventative approaches are being built into their respective restorative, protective and preservation activities.
- The PPO, in cooperation with local chambers of commerce, municipal and city works departments,

is promoting community-level involvement in the design of environmental programs. These community-driven programs represent an innovative forum for local residents, business, and governments to contribute to proactive abatement programs for a better environment.



III Additional initiatives

■ Objectives, guidelines, and standards

■ Provincial beaches program

■ Monitoring and surveillance

■ Emergency spills response

■ Enforcement

■ Research

■ OBJECTIVES, GUIDELINES AND STANDARDS

Provincial water quality objective development

MOEE develops provincial water quality objectives (PWQOs) and guidelines (PWQGs) for the protection of aquatic life and recreation. Levels specified by the objectives and guidelines represent a desirable quality of water. They are set at values which will protect all forms of aquatic life and all aspects of the aquatic life cycles during indefinite exposure to specific substances. The guidelines and objectives are intended to provide guidance in making water quality management decisions.

PWQOs are established when a defined minimum information base is available. If there is not enough information to meet the minimum information base necessary to set a PWQO, a PWQG is calculated. PWQGs are recommended with the intention of upgrading them to PWQO status when sufficient information becomes available.

- Ontario's water quality objectives and guidelines for aquatic life are among the most stringent of any jurisdiction on the Great Lakes.
- Ontario's approach considers both the potential of a chemical to bio-concentrate and its potential to cause mutation in aquatic life.
- The objectives and guidelines can provide a basis for deriving legally enforceable effluent requirements.
- Currently, Ontario has 136 PWQOs, PWQGs, and proposed PWQOs and PWQGs available for use.

- The number of criteria for the protection of aquatic life currently available for Michigan and New York State (or the number of criteria most appropriate for comparison to MOEE's PWQOs and PWQGs) are 63 and 65, respectively.

Ontario drinking water objectives

Ontario drinking water objectives (ODWOs) are the guidelines used to assess the acceptability of municipal drinking water in Ontario. Included are guidelines for substances related to health and aesthetics, microbiological indicators and radiological substances. ODWOs apply to water systems that serve five or more private residences or which are capable of supplying water at a rate greater than 0.5 litres per second. The legislative authority for ODWOs is the *Ontario Water Resources Act*.

- ODWOs closely follow the Canadian drinking water guidelines, which are developed by the federal/provincial sub-committee on drinking water; Ontario has representation on this sub-committee.
- The ODWO publication was last revised in 1983. Since then, many new guidelines have been developed and existing ones have been revised. A pamphlet listing tables of current ODWOs was published in the summer of 1992; a further update of the ODWOs will be printed in an October 1993 newsletter.
- Currently there are approximately 100 ODWO guidelines, 60 per cent of which are for organic substances. The updated ODWO publication is expected by December 1993.

Provincial sediment quality guidelines

MOEE recently has released its sediment quality guidelines which are to be used for all sediment related activities, such as disposal of dredged material and lakefilling. The guidelines define three levels of effect, or sediment quality, based on the chronic, long-term effects of contaminants in sediments, on aquatic organisms. These levels are:

- The no-effect level (NEL). At this level, the sediment is suitable for all water uses and has no negative effect on aquatic life. The NEL is derived using the provincial water quality objectives/guidelines, so the most sensitive water uses will be protected at this level.
- The lowest effect level (LEL) affects only the most sensitive organisms, representing a level of sediment contamination that can be tolerated by the majority of benthic (bottom-dwelling) organisms. Actual toxic effects become noticeable in the most sensitive organisms.
- The severe effect level (SEL) is the third level of sediment contamination. It is a level at which pronounced disturbance of the sediment-dwelling community can be expected and the sediment is found to be detrimental to the majority (95 per cent) of benthic organisms.

Built into the provincial sediment quality guidelines is a detailed implementation strategy that addresses application of the guidelines to sediment assessment activities, surveil-

lance and monitoring, spills cleanup, disposal of dredged material and lakefilling.

- The guidelines were put into effect on June 15, 1992 and replace the earlier open water disposal guidelines.
- Ontario was the first jurisdiction in the Great Lakes basin to issue sediment quality guidelines.
- Environment Canada, Ontario region, has adopted Ontario's guidelines on an interim basis, pending development of its own guidelines.

Lakefilling guidelines

In June of 1992, the province also announced new fill quality guidelines for lakefilling. The guidelines, which were released for public comment, provide interim guidance for all new lakefilling activities. The purpose of the guidelines is to protect the quality of the water and sediments by regulating the quality of the fill to be used in lakefill projects.

Fill which may be used for lakefilling projects is divided into two categories: confined fill and unconfined fill:

- Confined fill may be used for lakefilling projects provided it is placed within the confines of a structure, such as a dyke constructed of clean, non-erosive material. The intent is to prevent the fill from coming into contact with the open water and, in the event of a storm or high waves, being washed away. Confined fill must be of such quality that it can be declared inert.
- In order to be declared suitable for placement directly into water

outside of a confining structure, unconfined fill must first pass a set of more stringent tests including:

- bulk chemical tests whose results are compared with the provincial sediment quality guidelines for 11 metals and organic compounds including polychlorinated biphenyls (PCBs), arsenic, cadmium, chromium, copper, lead, mercury, nickel, zinc, total organic carbon and total phosphorus.
- the receiving water simulation test to determine whether or not metals and organic compounds such as PCBs will leach out from the fill.
- further tests which the ministry may request on a case-by-case basis which may include chemical analyses for nutrients, other metals and organic compounds.

• Ontario's sediment quality and lakefilling guidelines are the only biologically based guidelines for the management of contaminated sediments in the Great Lakes.

Projects involving lakefilling (or other changes to aquatic habitat) are also subject to various regulations, including work permit requirements administered by MNR. In dealing with such proposals, factors such as the effects on specific fish habitat (both local and through sediment transport) are considered, in addition to considerations of the quality of fill material.

PROVINCIAL BEACHES PROGRAM

A provincial beaches strategy was initiated by MOEE in December 1985. The goal of the strategy is to provide for the long-term upgrading and protection of recreational water quality.

In previous years, many beaches in Ontario have been posted by medical officers of health due to elevated bacteria levels, or excessive algae growth. From 1986 to 1992, all of the beaches along the Metro Toronto waterfront were posted as health risks to users. More than 120 beaches have been posted annually out of the more than 1,100 monitored across the province.

Since 1986, MOEE has participated with municipalities, conservation authorities and others in actions to identify the sources of contamination and develop plans to reduce beach problems. This has resulted in the development of environmental improvement plans such as pollution control plans (PCPs) for urban beach-

es and CURB plans for rural beaches. Studies undertaken in preparation of these plans have demonstrated that the most probable origins of recurring beach postings include urban stormwater runoff, agricultural drainage, combined sewer overflows, sewage treatment plant bypasses and discharges. In addition, these plans identify the most cost-effective corrective actions to improve beach quality.

Rural beaches program

The rural beaches program provides funding to conservation authorities to undertake the investigation of specific beach problems and the development of plans to clean up rural beaches. The CURB plans identify rural diffuse or non-point sources of beach contamination, such as rural land runoff, and cost-effective solutions.

- Nearly \$1.2 million has been committed to the development of the plans since 1991.

- Between 1991 and 1993, studies for the development of CURB plans were initiated by the following conservation authorities: Prince Edward Region, Napanee Region, Moira River, Lower Trent Region, Kawartha Region, Mississippi Valley, Ganaraska Region, Lower Thames Valley, Kettle Creek, Catfish Creek, South Nation River, Hamilton Region and Credit Valley.
- Nine CURB plans were completed between 1991 and June 30, 1993 by the following conservation authorities: Essex Region, Long Point Region, Raisin Region, Rideau Valley, Saugeen Valley, St. Clair Region, Kawartha, Prince Edward Region and the tri-authorities. (Moira River, Napanee Region and Lower Trent River).

CURB program

In September 1991, MOEE began to implement remedial measures to address non-point source discharges

which had been identified in the CURB plans.

- The program provides up to \$6 million per year in grants to farmers and other rural residents to carry out remedial actions to clean up rural beaches.
- Eligible items for grant assistance include private sewage disposal systems, livestock access restriction and alternate watering systems, manure storage and handling, and milkhouse washwater disposal systems.
- A total of 18 conservation authorities and one RAP area (Severn Sound) are currently participating in the program.
- As of March 31, 1993, MOEE has approved 1,200 projects with a total grant value of \$5.3 million since the initiation of the CURB program on September 1, 1991.

Urban beaches program

Under the LifeLines program, which was initiated in 1986, MOEE offers financial (50 per cent grant) and technical assistance to municipalities to develop a pollution control plan. The purpose of a PCP study is to: outline the nature, cause and extent of water pollution problems in a municipality; propose alternative remedial measures; recommend an implementation program.

- During 1991 and 1992, MOEE allocated \$1.08 million in grants to municipalities for 13 ongoing PCPs, 10 in the Great Lakes basin. The majority of these municipalities undertaking PCP studies have beach problems. By the end of 1992, pollution control plans for areas within the Great Lakes basin had been completed in the regional municipalities of Niagara (Fort Erie and Port Colbourne), Durham and Hamilton-Wentworth, and the cities of Peterborough, St. Catharines, London, Windsor

(Little River) and Toronto. Studies are still ongoing in the cities of Sarnia and Windsor (Riverfront).

Under the beaches improvement program (BIP), capital grant funding is provided to municipalities to implement corrective measures identified in the PCP. Capital expenditures allocated to municipalities under BIP for 1991 and 1992 totalled \$43.1 million. Current eligible items for grant assistance include:

- control of combined sewer overflows (CSOs);
- stormwater pollution control in developed urban areas;
- capacity expansion and/or modifications of a sewage treatment plant to accommodate treatment of flow resulting from an improved upstream collection system;
- modifications and/or additions to a sewage treatment plant to improve effluent quality;
- construction of beach pollution remedial works.

- Projects undertaken for beach improvement in 1991 and 1992 included the construction of CSO detention facilities in Metro Toronto, the city of Toronto, and the regional municipality of Hamilton-Wentworth. These facilities are used to detain CSOs and/or stormwater accumulated during periods of heavy rainfall, for later processing at sewage treatment facilities. This allows for more effective use of existing treatment facilities and reduces overall the amount of overflows and by-passes to the waters which receive these discharges.
- MOEE has funded several projects that examine innovative methods for the control of CSOs, examples being the installation of a Dunkers stormwater flow balancing system in the city of Scarborough and the implementation of a computerized Real-Time Control system in the regional municipality of Hamilton-Wentworth. The use of other non-traditional technology, such as the operation of the ultra violet (UV) disinfection unit at the Fanshawe Reservoir Beach Park in London, has permitted swimming at a beach which previously had been perpetually closed.

Figure 1 illustrates the number of days on which monitored beaches were placarded (closed) for the period from 1988 to 1992. Examination of the figure reveals that beach postings in 1992 were down in all Ontario regions, with the exception of southwestern Ontario. MOEE added 10 beaches to southwestern region's monitoring list in 1992.

MONITORING AND SURVEILLANCE

Great Lakes investigations and surveillance program

MOEE undertakes a comprehensive surveillance and investigations program for the Canadian Great Lakes and connecting channels. The provincial program generates information which simultaneously assists the federal government in meeting international obligations under the GLWQA and serves provincial regulatory needs.

Historically, the province has assumed the primary responsibility for nearshore monitoring activities, while the federal government has played the lead role in open-lake, offshore surveillance and in maintaining involvement in transboundary and international issues. During the last six years, primary provincial attention has been given to technical assessments in support of the 17 Canadian RAP sites.

In addition to the high priority commitments generated by the RAP program (Annex 2 of the GLWQA), the agreement dictates a commitment to basin-wide surveillance (Annex 11) and support of a long-term state-of-the-lakes database. These two requirements currently are supported through a range of ongoing surveillance activities which are carried out in addition to investigations of specific sites and problems.

- RAP surveillance and monitoring. Since 1985, surveillance efforts of the ministry have been geared extensively towards completion of

Stage I and Stage II RAPs at the 17 Canadian (or binational) areas of concern. This activity has been required to document environmental conditions and define problems and to track the effectiveness of those remedial actions which have been put into place.

- Long-term sensing sites. This activity was initiated in 1989 and covers the Great Lakes during a five-year cycle to track trends in ecosystem health (e.g. benthic enumeration, chemicals in water, sediment and biota). Trend information will start becoming available as sites are re-visited.
- Tributary mouth biomonitoring. This activity also was initiated in 1989 and covers the Great Lakes on a five-year cycle. The intent is to monitor the integrated effects of large tributary drainage basins on the Great Lakes nearshore environment through the collection and analysis of young-of-the-year fish. The activity has been designed to complement other, ongoing fish collection and analysis activity. Trend information will become available on a lake-by-lake basis over the next sampling cycle.
- Great Lakes embayments and harbors investigations. This activity was initiated in 1988 in collaboration with MOEE regional offices. The objective is to ensure that areas not designated as areas of concern undergo a screening level assessment of environmental conditions and problems.

These surveillance activities, in combination with various site-specific investigations, have identified sources and quantified loadings of persistent contaminants to the Great Lakes basin from both point and non-point sources (including industrial and municipal dischargers, urban and agricultural runoff and tributaries).

To provide a general picture of conditions throughout the Great Lakes system, the following table draws upon recent data to summarize average daily loadings or deposits (from Canadian and American sources) for cadmium, lead, mercury, zinc, total PCBs, hexachlorobenzene (HCB) and mirex to the four Great Lakes connecting channels and Lake St. Clair. Loadings information for phosphorus and chloride also have been included.

Contaminants deposited into the connecting channels from the

atmosphere are not included in the loadings summary, although urban runoff loadings include local atmospheric deposits to the immediate watershed. Atmospheric contributions are anticipated to be much more important in water bodies with large surface areas, such as lakes, rather than in rivers.

- Despite the fact that there are losses of some of these contaminants through natural processes as they are carried downstream through the Great Lakes system, the table shows the cumulative effect of deposits resulting in successively higher loadings from one downstream connecting channel or lake to the next. This is particularly evident for chloride, mercury and PCBs.
- For certain contaminants in some areas, local sources may constitute only a fraction of the total load

when compared to the cumulative load from upstream sources.

- These data also demonstrate the presence of some of these contaminants in relatively clean Great Lakes waters, such as Lake Superior, albeit at very low concentrations. Although there are (or have been) local sources of contaminants such as mercury, PCBs, and HCB to the nearshore of this lake, the majority of these contaminants reach the lake via long-range transport through the atmosphere.
- This highlights the mobility of many persistent and bioaccumulative contaminants. It also indicates that, to be effective in reducing concentrations in water, sediments and biota, the control or elimination of these contaminants from sources must be equally stringent in all parts of the Great Lakes basin.

☐ SUMMARY OF GREAT LAKES CONNECTING CHANNELS CONTAMINANTS SOURCE LOADINGS,
IN KILOGRAMS/DAY.

CONTAMINANT	LAKE SUPERIOR INPUT TO ST. MARYS RIVER	ST. MARYS RIVER SOURCES	LAKE HURON INPUT TO ST. CLAIR RIVER	ST. CLAIR RIVER SOURCES	ST. CLAIR RIVER INPUT TO LAKE ST. CLAIR	LAKE ST. CLAIR SOURCES
Chloride	251,856	34,924	320,000	400,481	4,200,000	490,927
Phosphorus	1,749	120	720	222	5,500	3,544
Zinc	266	41	130	79	1,100	388
Lead	-	12	7,500	21	160,000	179
Cadmium	-	0.0021	-	0.321	-	4.6
Mercury	0.1901	0.0067	0.09	0.0421	6.6	0.3997
PCBs (total)	0.00000062	0.0090	0.0 (nd)	0.0900	0.3	0.0293
Hexachlorobenzene	0.00000005	0.000016	0.01	0.0295	0.8	0.00562
Mirex	-	-	-	-	-	-

CONTAMINANT	LAKE ST. CLAIR INPUT TO DETROIT RIVER	DETROIT RIVER SOURCES	OUTPUT TO LAKE ERIE	LAKE ERIE INPUT TO NIAGARA RIVER	NIAGARA RIVER SOURCES	NIAGARA R. OUTPUT TO ST. LAWRENCE R.	LAKE ONTARIO INPUT TO ST. LAWRENCE R.
Chloride	3,828,000	1,449,956	4,704,000	-	-	-	17,016,955
Phosphorus	4,650	3,958	7,700	-	-	-	7,432
Zinc	667	1,440	1,428	1,356	279	2,074	-
Lead	69	247	93	613	4.3	609	-
Cadmium	10	25	18	585	0.37	593	-
Mercury	5.9	8.86	14	8.1	0.1264	11.8	-
PCBs (total)	0.81	1.051	1.86	2.20	0.0720	10.54	0.1014
Hexachlorobenzene	0.19	0.00343	0.19	0.0577	0.0838	0.2290	0.00548
Mirex	-	-	-	0.0	0.0	0.0171	0.005497

Notes: "-" indicates data not available.

Drinking water surveillance program

MOEE's drinking water surveillance program (DWSP) monitors drinking water quality at municipal water supply systems across the province. The program provides:

- immediate, reliable, current information on drinking water quality;
- a mechanism for flagging samples of water which exceed drinking water objectives;
- information on contaminant levels and trends;
- background information to help assess the need for remedial action;
- an indication of the efficiency of plant processes in treating water.

DWSP officially began in April 1986 and is designed to include eventually all municipal water supplies in Ontario. In 1990, 76 systems were being monitored. By 1992 the number of supplies had increased to 109,

representing the drinking water sources for approximately 85 per cent of the population. Most of these are surface water systems and 56 are located on the Great Lakes and adjoining waterways (Figure 2).

Each time a location is sampled, separate samples are gathered from the raw, treated and distribution water. These are analyzed for the presence of nearly 200 substances or parameters at a frequency of two to 12 times per year. Sixty-five per cent of the parameters are organic chemicals. Plants also must test monthly for bacteria. Substances which are measured may have health or aesthetic implications when present in drinking water.

Water quality is judged by comparing the program's monitoring results with the limits set out in the MOEE's Ontario drinking water objectives. If monitoring reveals contamination at levels which exceed a health-related

limit, the water utility is notified, additional sampling is conducted and appropriate remedial action is taken, if necessary.

Annual reports summarizing the data for each of the water supplies participating in the program are available to the public. The reports contain all of the testing results and report any instances of samples exceeding the objectives. The reports also contain a schematic diagram of the water treatment process for each individual water treatment plant.

- Monitoring treated drinking water at locations on the Great Lakes basin during 1990, 1991 and 1992 generated more than 80,000 analysis results for synthetic organic contaminants and pesticides.
- Trihalomethanes (THMs, i.e. chloroform, chlorodibromomethane, dichlorobromomethane and bromoform) are the most widely occurring synthetic organic



substances found in drinking water. The formation of THMs results when the chlorine used for disinfection reacts with natural organic matter in the raw water. Total THM levels in Great Lakes drinking water supplies were well below the health-related ODWO.

- Almost four per cent of the results indicated traces of chemical substances present. A trace means that the level of a substance measured is greater than the lowest value detectable by the analysis method, but lies so close to the detection limit that it cannot be confidently measured. A small number of the results (approximately 0.07 per cent) showed some substances present at low levels, but above trace levels.
- More than 45,000 analyses for substances having health-related ODWOs were conducted from 1990 to 1992. The only health-related limit exceeded was turbidity. Turbidity in water is caused by the presence of suspended matter such as clay, silt, plankton and other microscopic organisms. The most important health effect of turbidity is possible interference with disinfection and maintenance of a chlorine residual. The ODWO for turbidity was exceeded six times (less than one per cent of the analysis results) during 1990-1992. However, the drinking water in each case was confirmed to be microbiologically safe.
- Information from the DWSP database indicates that municipally

treated drinking water from locations on the Great Lakes is generally of very good quality.

Sport fish contaminant monitoring program

MOEE and MNR collect and test sport fish in order to measure the contaminant concentrations from locations throughout the Great Lakes and connecting channels. Information from this program is provided to the public through the biennial *Guide to Eating Ontario Sport Fish* (now in its 17th edition), which provides recommended levels of consumption of sport fish based on guidelines developed by Health and Welfare Canada. In 1993, advice is provided for more than 1,600 locations across the province including 214 locations on the Great Lakes and connecting channels.

The program can test sport fish for more than 70 substances, but not every fish is tested for all substances. All sport fish collected are tested for mercury, which causes almost all of the consumption restrictions for fish from inland locations. Sport fish from the Great Lakes are generally tested for a range of additional contaminants including: PCBs, mirex, DDT, dioxins and furans, chlorinated phenols and benzenes, and polynuclear aromatic hydrocarbons (PAHs).

Between 1990 and 1992, the laboratory procedures were improved to permit the quantification of the 17 most toxic forms of dioxins and furans. Expanded testing of sport fish for dioxins and furans, as well as a

more stringent guideline (as a result of including toxic isomers of dioxins and furans in the guideline), has resulted in new consumption advisories in the 1993-94 *Guide* for some of the Great Lakes' fish, particularly lake trout and brown trout. Lake trout in Lake Ontario now have consumption advisories for sizes larger than 45 cm, due to dioxin/furan levels found above the guideline in samples taken at various locations. Larger sizes of lake trout in southern Lake Huron and at two locations on Lake Superior (Jackfish Bay and Peninsula Harbour) also have consumption advisories due to elevated dioxin/furan levels.

- As a result of the testing of sport fish from the Great Lakes since the early 1970s, long-term trends have been established at some key angling locations.
- The trends indicate a major decline in the levels of PCBs, DDT and other organic contaminants from sport fish in all the Great Lakes locations during the 1970s and early 1980s, along with a decline in mirex levels in Lake Ontario sport fish.
- In recent years, contaminant levels in most locations appear to have levelled off. However, Lake Ontario salmon and trout have shown an increase in PCB and mirex levels since 1990 and monitoring will continue to determine if this is a trend situation (Figure 3).

*Young-of-the-year fish
contaminants monitoring program*

In 1975, a common forage fish, the spottail shiner (*Notropis hudsonius*), was adopted as a biomonitor by MOEE to identify areas of concern in nearshore waters of the Great Lakes. During a 17-year period (1975-1992) shiners have been collected and tested from more than 150 sites on the Great Lakes and their connecting channels.

Routinely, fish are tested for about 25 organic and inorganic substances, and selectively for chlorinated dioxins, furans and PAHs. Residues found in shiners reflect the availability of contaminants for a specific area, and they offer a data base for comparison of contaminant levels, or trends, through time. Furthermore, these forage fish provide a link in contaminant transfer to higher levels of the food chain, such as fish-eating wildlife birds and predatory fish. Wildlife protection criteria or guidelines are used to assess contaminant residues found in field collections.

- Survey results from the most recent 1990-91 data show that of all the substances tested, only PCBs and mirex residues exceeded wildlife protection guidelines.
- Although 14 of 38 (37 per cent) shiner samples collected in 1990-91 had PCB concentrations above the IJC aquatic life guidelines (Figure 4); PCB concentrations in shiners collected during the 1980s and early 1990s were considerably lower than those from the 1970s (Figure 5).

- A similar observation can be made for all the other common organochlorine contaminants tested (Figures 6-7).

*Air quality monitoring in the
Great Lakes basin*

Many toxic organic compounds are carried in the atmosphere and are distributed from there broadly throughout the Great Lakes. In addition, local industrial and local vehicle emissions also contribute to contamination in the Great Lakes. The atmosphere may be the principal pathway by which toxic substances reach the upper Great Lakes (lakes Superior, Huron and Michigan).

In 1990 an integrated atmospheric deposition network (IADN) was created to monitor toxic organic compounds and trace metals in air and precipitation. The network has both U.S. and Canadian monitoring stations. Specific goals of the IADN include determining the identity and concentrations of toxic organics in air and in precipitation and quantifying atmospheric deposition of these compounds to the Great Lakes. At present, seven MOEE stations monitor atmospheric deposition of PCBs, organochlorine pesticides, PAHs and dioxins in the Great Lakes basin. It is expected that most of these stations will be incorporated into the IADN by the end of 1993.

For the most part, reductions of airborne toxics must be achieved through reductions by industrial sources and through tighter emission limits on vehicles. New, stringent

emission limits for nitrogen oxides and volatile organic compounds, including numerous air toxics, to be applied to light duty vehicles, should result in significant vehicular emission reductions; emission limits will be phased in during the 1994 through 1996 vehicle model years.

In 1991, MOEE initiated a novel, community-based study in Windsor, Ont. The two-year program, which includes extensive ambient air monitoring, vegetation and soil monitoring, emissions inventory and personal exposure studies, was initiated to identify the sources of the greatest airborne risks posed to humans and the natural environment in the city.

- The Windsor study was completed in the summer of 1993. Data analyses are currently underway, but preliminary results indicate a major impact on Windsor air quality from industrial sources in Detroit and, on the Windsor side, from the automobile manufacturing sector and vehicular traffic.
- When available, the final results of this study will create a greater understanding of the toxics deposited into the terrestrial ecosystem and, by extension, in the Great Lakes. This will assist provincial regulators in focusing on the most serious contributors to the airborne pollution problem.

EMERGENCY SPILLS RESPONSE

Response to spills in the Great Lakes basin is a responsibility shared by numerous agencies and jurisdictions.

The first Ontario government spill contingency plan was prepared in 1968 and it dealt primarily with spills to Lake Erie and Lake Ontario. The plan was expanded by 1973 to respond to spills throughout the province. The province amended the *Environmental Protection Act* by introducing specific spills legislation, currently Part X, which came into force in 1985. The spills provisions of the act strengthened reporting requirements, introduced cleanup requirements, introduced rights to compensation and a compensation and cost recovery mechanism, and provided for related support mechanisms including the ability for the province to take charge when necessary.

MOEE established a Spills Action Centre in 1985 to provide province-wide 24-hour-per-day toll-free access to the ministry for spills and other urgent environmental matters. In early 1986, the ministry introduced a province-wide off-hours environmental response program to provide a round-the-clock regulatory field response for spills and other occurrences.

- MOEE's Spills Action Centre deals with approximately 16,000 occurrences annually. These include about 12,000 unscheduled releases of pollutants to the natural envi-

ronment of which just more than 5,000 are spills as defined by Part X of the *Environmental Protection Act*.

- Approximately 80 per cent of the spills in Ontario occur within the Great Lakes basin.
- The number of reported spills for all of Ontario increased by about 20 per cent per year from the mid 1980s, peaking at 5,600 in 1990. The first decrease in reported spills occurred in 1991 when there were eight per cent fewer spills than in 1990. A further decrease of about five per cent occurred in 1992.

Approximately 50 per cent of all spill occurrences are classified as oil spills, 20 per cent as chemicals or chemical solutions, 13 per cent as spills of substances to the atmosphere and 17 per cent spills of wastes and other substances. Spills volumes have decreased by a factor of approximately 10 over the last 15 years. Even though the number of spills reported increased significantly during this time frame, the total amounts or volumes of pollutants spilled to the environment appears to have declined to about half of what was spilled 15 years ago. This compares to similar observations made elsewhere by European and U.S. observers.

- In 1992, there were 203 spills of oils and chemicals (including chemical solutions) to the Great Lakes system, 85 fewer than in 1991. Figure 8 shows the number of spills to each of the Great Lakes and their connecting channels, for 1992.

From the attached figure on spill volumes for 1992 (Figure 9), it is evident that a large proportion of spills reported in Ontario involve oils and many of these were of relatively small quantities.

- Twenty-three per cent of the oil spills were less than 10 litres, 65 per cent were less than 100 litres and 95 per cent were less than 1,000 litres (about the size of a home heating fuel tank).
- These figures are indicative of a continuing trend by industry and others to report more small volume spills which may not have been considered reportable several years ago.

Part X of the *Environmental Protection Act* requires that spills be cleaned up promptly and to the extent practicable. It places the primary cleanup responsibility on the discharger, that is the person who owned as well as the person who had control of the pollutant immediately prior to the spill. For the most part, spills are cleaned up directly by those responsible or indirectly by their contractors or industrial spill cleanup cooperatives. Municipalities provide cleanup response on an as-required basis.

- The province had to assume direct control for the cleanup only of seven spills within the Great Lakes basin during the two-year period ending Dec. 31, 1992. Of these, two involved spills directly to the waters of the Great Lakes.
- The remainder of the occurrences were dealt with satisfactorily by

the discharger, sometimes with the assistance of various response agencies.

Another key objective of MOEE is to ensure that municipal drinking water supplies are protected against the impacts of chemical spills. In addition to relying on sampling results, computer models have been developed which are used to simulate the likely behavior of chemical plumes. Thus, it is possible to determine what municipal intakes potentially will be impacted, when the impact will occur, what the likely concentrations of the chemical will be, and what safe drinking water criteria are to be considered for the spilled chemical. MOEE staff then provide this information to the water treatment plant operators and monitor the passage of the chemical plumes.

- On the St. Clair River, between January 1991 and February 1993, water treatment plants were shut down on eight occasions. In almost all cases, shutdowns were precautionary measures only and were not due to predicted or measured examples of drinking water standards being exceeded.

ENFORCEMENT

Environmental protection in Ontario is guided by five acts: The *Environmental Protection Act* (EPA), the *Ontario Water Resources Act* (OWRA), the *Pesticides Act* (PA), the *Environmental Assessment Act* (EAA) and the *Niagara Escarpment Planning and Development Act* (NEPDA). Together, they form the legal foundation for pollution prevention and control in Ontario. MOEE enforces these laws and regulations.

Investigations leading to enforcement through administrative action or prosecution under these laws can be triggered in a variety of ways. These include public complaints, the reporting of spills, notification of an incident by industry, discovery by MOEE investigators and/or through inspections by MOEE officers.

- During the period from 1985 to 1991, there has been almost a four-fold increase in the number of prosecutions initiated and convictions obtained by MOEE. In general, fines are becoming larger, and more and more environmental prosecutions are resulting in the conviction of individuals as well as the companies they work for. This means that senior staff are being held personally responsible for their company's actions. In addition, prosecutors are thinking not only in terms of fines, but also in terms of jail sentences.

- In 1992, Bata Industries Limited was fined \$60,000 for impairing water quality and ordered to pay an additional \$60,000 (reduced on appeal to \$30,000) in local financial assistance. In addition to the corporate fine, the company president and director were fined \$13,000 each, reduced on appeal to \$6,000 each.
- There also has been a shift in recent years towards creative sentencing of convicted individuals, where convicted offenders pay their debt to society by directly improving the environment they harmed.
- With respect to violations having an effect on the Great Lakes, of the individuals and companies charged by MOEE during the period of Jan. 1, 1991 to Dec. 31, 1992, 10 cases and 12 defendants were convicted of 19 charges, resulting in a total of \$251,500 in fines.

RESEARCH

MOEE has actively supported environmental research inside and outside the ministry for many years. Even with today's serious fiscal constraints, the ministry distributes \$1.5 to \$2 million annually to university and contract researchers for issues related to the aquatic environment, the atmosphere, waste management, pollution prevention, waste reduction (3Rs), and a variety of other issues such as pesticide control. Following is an overview of research issues of particular interest to the Great Lakes.

The impact and control of zebra mussels

MNR and MOEE have, in recent years, undertaken a program to fund research on zebra mussels directed to immediate solutions to eliminate or reduce the buildup of zebra mussels on water intakes.

- Fifteen projects for zebra mussels research have been funded by the province since 1991; their cost totalled \$713,841.
- A number of these projects have been approved to look into various control techniques, such as ultraviolet radiation, heat, electric current, turbulence (e.g. bubbles), pH adjustment and calcium availability as well as chemicals (chlorine and alum).

Alone and in various combinations, these techniques are being assessed for their effectiveness, efficiency and practicality. This funding program is quite new and the results of research are just now becoming available; within a year, much should be known about practical means of controlling this serious problem.

Ontario also has recently funded research to look into the possible impact that zebra mussels might have on the cycling of persistent organic

substances such as PCBs as well as metals in the Great Lakes. The potential of this filter feeder to remove hazardous materials from the water column and to immobilize them temporarily or permanently in the sediments through biodeposition is being explored at Great Lakes sites. Results stemming from this research project should begin to become available soon for practical application by aquatic research managers.

General environmental understanding and management

MOEE is conducting and supporting a wide variety of research which is directly applicable to the Great Lakes issues, including:

- eliminating contaminants from the aquatic, atmospheric and terrestrial environments through improved industrial, agricultural and municipal waste treatment and pollution prevention measures, for example;
 - EcoLogic International Inc.'s development of a new thermo-chemical reduction process for the destruction of PAHs, PCBs and other organic compounds from sediments (\$311,800)
 - Jasmotech Metal Technologies Inc. use of Vitrokele technology to

- capture and recycle cyanides and metals at gold plants (\$406,000)
- Halozone Recycling Inc.'s method for recovery and recycling of CFCs (\$894,066)
- developing sophisticated procedures and equipment that will be used to analyze and identify the sources, distribution and fate as well as the environmental and human health significance of hazardous materials which are in or have been lost to the environment;
- developing and applying equipment and procedures for the provision of safe drinking water supplies;
- protecting groundwater resources.

It should be noted that specific information related to the purpose and objectives, costs, schedule, and details for Great Lakes-related research can be found most conveniently in the IJC Great Lakes - St. Lawrence research inventory prepared and annually updated by the Council of Great Lakes Research Managers. This comprehensive compendium of recent research is catalogued according to a detailed classification code that permits the rapid identification of all appropriate Canadian and U.S. research.

IV Provincial partnerships

■ Provincial agricultural activities

■ Protection of ecosystems and habitats

■ PROVINCIAL AGRICULTURAL ACTIVITIES

Encouraging the move towards sustainable agricultural systems, the Ministry of Agriculture and Food (OMAF) is considering issues such as the excessive use of pesticides, contamination of water supplies, constructive approaches to soil erosion and effective use of available water. OMAF's actions on these issues should reduce rural non-point sources of pollution to the Great Lakes basin and so improve water quality.

Current resource conservation activities in OMAF can be summarized in three areas:

- OMAF programs such as Land Stewardship II and Food Systems 2002;
- partnership with the federal government through programs such as SWEEP, the land management assistance program, the environmental sustainability initiative and Green Plan;
- partnership with the agricultural industry, notably by supporting its initiatives under the coalition of Ontario farm organizations to develop environmental farm plans.

OMAF Programs

The land stewardship II program was begun in 1990, to extend and integrate initiatives previously undertaken by OMAF and farmers which placed a stronger emphasis on conservation farm planning. Under this program, financial incentives are provided to:

- protect soil from erosion by practices such as reducing tillage (and leaving more crop residue on the ground surface) and constructing erosion control structures such as grassed waterways;
- control sources of pollution by constructing manure storage facilities, milkhouse waste water treatment systems, and improved pesticide storage and mixing areas.

OMAF contracted the Ontario Soil and Crop Improvement Association to deliver the program in the field. By involving farmers in the program delivery, in every county of the province a corp of farmers became actively involved in promoting soil and water conservation in their local area.

Figures 10 and 11 show the equipment and structures for which grants were paid for conservation practices, the numbers of farmers who were assisted and the total area affected. These figures only reflect those farmers who were assisted under the program. It is known that these figures under-represent the farmers who are actually undertaking these practices.

The goal of the food systems 2002 program is to reduce pesticide use on agricultural crops by 50 per cent by the year 2002. The Ontario pesticide education program (OPEP) is one component of Food Systems 2002, carried out in cooperation with MOEE. The courses offered include instruction on proper pesticide handling for both human and environmental safety. Currently, any vendor wishing to sell agricultural pesticides, or any farmer wishing to purchase

pesticides, must have taken the appropriate course under OPEP within the past five years. Figure 12 illustrates the number of vendors and farmers having taken courses under OPEP.

A second component of Food Systems 2002 is research. Between 1988 and 1992, a total of \$3.7 million was allocated to 95 research projects, such as those looking into the non-chemical alternatives to herbicides for weed control in turf or the reduced usage of herbicides in sweet corn.

Field delivery of integrated pest management (IPM) technology is the final component of Food Systems 2002. Integrated pest management is the reduction of chemical pesticide use through the identification of the point where the cost of further pest management exceeds the savings through reduction in crop losses. Through the Agri-A-Phone system, producers have 24-hour access to IPM information. As shown in Figure 13, IPM information was available for more than 400,000 hectares of farmland in 1991-92.

The Partners in Nitrogen Study, begun in 1990 and completed in 1992, was a partnership between the Fertilizer Institute of Ontario, the Universities of Guelph and Waterloo, OMAF and cooperating farmers. The study assisted in the development of a soil nitrogen test, which can be used to better predict crop nitrogen fertilizer requirements and thereby reduce the impact of nitrogen fertilizer on groundwater quality.

Although the results were variable (the test worked about 70 per cent of the time), the study showed that if the soil nitrogen tested above 110 kilograms per hectare (kg/ha), addition of nitrogen fertilizer to the field had little or no effect on crop yield. This test currently is being used by farmers to assist them in improving the efficiency of their use of fertilizers.

Programs in partnership with the federal government

In 1985 the federal and provincial governments initiated the soil and water environmental enhancement program (SWEEP), which had two principle goals: to reduce phosphorus loadings to Lake Erie by 200 metric tonnes per year from diffuse or non-point agricultural sources, and to maintain or improve the productivity of the agricultural sector in southwestern Ontario by reducing soil erosion and degradation. To meet the program objectives, it was estimated that 8,000 farmers cropping 400,000 hectares of land must adopt conservation tillage and cropping practices (such as those described under Land Stewardship II).

Most of the dollars contributed by the federal government under SWEEP were matched by the Ontario government under the Ontario soil conservation and environmental protection assistance program (OSCEPAP). While this ended in March 1990, OMAF has continued to participate in many of the activities of SWEEP beyond 1990 by providing on-going technical assistance on conservation technology for farmers through local demonstrations. Field technical staff conduct demonstration projects which provide farmers with direct experience of the differences between tillage practices, including economic considerations. These important resources have been maintained through the land stewardship II program.

A final aspect of SWEEP, for which Ontario has taken the lead, is in monitoring the impact of the program. A survey on cropping, tillage, and land management practices in southwestern Ontario was carried out in 1986 and repeated in 1991, to collect data on farm crop rotations, tillage practices and fertilization – practices that have an impact on phosphorus delivery to the Lake Erie watershed. Results show that there has been a general increase in practices which tend to reduce phosphorus loads (Figure 14).

The partnership that began with SWEEP has been continued in support of other federal activities. Generally, OMAF has matched federal financial contributions with expenditures under the land stewardship II program, and provides field technical expertise and delivery assistance for the following initiatives.

The environmental sustainability initiative (ESI) was a one-year program established in 1991/92 to facilitate effective resource management in agriculture. The province assisted this program mainly by developing manuals of best management practices (BMP) and conducting the Ontario farm groundwater quality survey (Winter 91/92).

The BMP manuals initiative is a joint project between the Ontario Federation of Agriculture, Agriculture Canada and OMAF. The manuals provide information to assist farmers in planning environmental improvements in their operation. Although these manuals were initiated under ESI, they continued to be supported by the federal land management assistance program and the federal Green Plan. Nine manuals have been produced which provide information to farmers in an easily accessible form on ways to control runoff from manure storages, implement conservation farming practices and improve wildlife habitats along watercourses on a farm.

The Ontario Farm Groundwater Survey also was initiated under ESI. This study is the first province-wide study of farm well water quality in Ontario. Approximately 1,300 randomly selected wells were sampled. The results of the study indicated that 37 per cent of the water samples had levels of bacteria and/or nitrates above the provincial drinking water quality objectives. The objective for bacteria was exceeded in 31 per cent of the samples. The guideline for nitrate was exceeded in 13 per cent of the samples. This survey was repeated in the summer of 1992.

Partnerships with the agricultural industry

In January of 1992, a coalition of Ontario farm organizations announced their agenda for addressing environmental issues in agriculture. The top priority on the agenda was to ask every farmer to complete an environmental farm plan (EFP) for his or her enterprise. The plan, developed with the assistance of a workbook, includes an assessment of environmental risk on every aspect of farm operations, with established priorities and action plans. The coalition expects that 40,000 plans will be completed during this decade.

With financial assistance from the federal land management assistance program, and technical assistance from OMAF, farm organizations are undertaking

a pilot project to field test the environmental farm plan process. A total of 500 farmers in seven counties across the province are currently taking part.

PROTECTION OF ECOSYSTEMS AND HABITATS

The Ontario Ministry of Natural Resources (MNR) operates fisheries assessment units on each of the Great Lakes. Information on stock and habitat status and harvest rates is collected and reported annually and used to manage commercial and sport fisheries on a sustainable basis. This information also tracks improvements resulting from habitat rehabilitation, or deterioration resulting from stresses such as erosion, wetland losses, and interference from introductions of exotic species.

Status of fish stocks in Ontario waters

Lake Superior

- Lake herring stocks are making a strong recovery from severe overharvesting which occurred until 1988.
- Lake trout now have reached 40 per cent of historical levels, prior to their population collapse in the 1950s due to overharvesting and the introduction of the parasitic sea lamprey.
- Ruffe, a European perch-like fish, was discovered in St. Louis Harbour, Duluth, Minn. in 1987, likely released in ballast water from an ocean-going ship. This is another

introduction of an exotic species like the sea lamprey and the smelt. Ruffe, however, is of little economic value, and has the potential to interfere with game fish through competition and preying on eggs and larval fish. The ruffe has expanded its range, moving along the southwest shore of Lake Superior in Wisconsin. Several adult fish were caught in Thunder Bay, Ont. in 1992, again likely transferred in ballast water from St. Louis Harbour. The major potential source of transfer, the vessel Incan Superior, has ceased sailing between Thunder Bay and Duluth so the potential for transfer of ruffe between these ports has been significantly reduced. Cold temperatures and long distances between pockets of suitable habitats may be limiting the spread of ruffe elsewhere in Lake Superior.

Transfer in ship ballast water to the lower Great Lakes and into prime ruffe habitat remains a possibility. An integrated control program to stop the spread of ruffe within the Great Lakes has been implemented by the Aquatic Nuisance Species Task Force. The program involves both U.S. and Canadian management agencies. Of significance in the ruffe control program is a ballast water management plan voluntarily implemented by lake carriers in the spring of 1993.

Lake Huron

- The whitefish family of fishes (herring, cisco, whitefish), historically a mainstay of the coldwater fish community, is emerging again as a major source of fish production.

Lake whitefish landings in the main basin of Lake Huron and the North Channel have reached record proportions. There are also signs that Georgian Bay stocks are improving. Bloater (a deepwater cisco) has returned to the high levels last seen in the early 1960s. Quota management cooperatively implemented by the commercial fishery and MNR is contributing to the boom.

- Lake trout rehabilitation is proceeding slowly. Natural reproduction has been documented in two planting areas. However, high mortality rates, particularly in northern Lake Huron, are preventing any buildup of spawning stocks.
- Adult sea lamprey, which attach to fish and parasitically drain their blood, increased in numbers in 1992 and threaten lake trout rehabilitation in parts of the lake. In the north, sea lamprey account for up to 50 per cent of adult lake trout losses and are inflicting wounding rates on whitefish that rank with pre-1950 levels when lampricide came into use as a control.
- The prey species remain numerous and diverse and growth rates of top predators (salmon and lake trout) seem fairly static.

Lake Erie

- The success story for the world-class walleye fishery continued in 1992, with 2.43 million fish caught by angling and 2.40 million taken commercially. The total catch was 71 per cent of the recommended allowable harvest. Estimated

harvests for 1993 will be near 6.355 million fish, well within a range that would protect the walleye stocks.

- Yellow perch harvests in 1992 totalled 5.8 million pounds, five per cent less than the 1991 catch. Stock statistics suggest a similar harvest level could be supported in 1993.
- Lake whitefish populations have increased dramatically in eastern Lake Erie in the past several years as water quality has improved and in the absence of a commercial fishery.
- Over the next decade, changes are expected in the primary productivity and the nutrient status of Lake Erie. Subsequent shifts downward are expected in the production and yield of species such as walleye, yellow perch and rainbow smelt. Part of the changes are undoubtedly the result of reduced nutrient loadings, but the overall effects of zebra mussel colonies (e.g. increased water clarity) may be accelerating these changes.

Lake Ontario

- The historically healthy and productive fish community reached its lowest point in the mid-1960s, resulting from devastating overfishing, nutrient enrichment and intensive preying by sea lamprey. Alewife and smelt populations grew unchecked and significant alewife die-offs occurred throughout the 1960s. Large numbers of salmonids were introduced in the 1970s to control prey species and now provide a popular sport fishery.

- The production of zooplankton declined by 50 per cent in upper water layers following a very successful phosphorous control program. As a result, smelt and alewives, the dominant component of salmon and trout diets, declined dramatically. At the same time, agencies increased stocking of predatory salmonids from one million fish in 1972 to 8.2 million in 1984, the latter a level that continued up to 1990. This has severely constrained alewife and smelt populations and has put the sport fishery at risk.
- An overall reduction in longterm productivity of Lake Ontario is expected to reduce size and numbers of species like lake trout and chinook salmon. Agencies are proposing major reductions in stocking of these species starting in 1993.

Zebra mussels program

The zebra mussel was first discovered in Ontario in Lake St. Clair in 1988. It is believed that the mussels arrived in Ontario in 1986, in the ballast water of a freighter originating from a European port. Since that time, they have spread rapidly to all the Great Lakes, interconnecting channels and some inland waters (Figure 15).

It has been estimated that \$500 million per year is being spent in the Great Lakes basin repairing damage due to zebra mussels. They have caused extensive damage to water intake pipes used by municipalities, industries and electrical utilities on the Great Lakes. Veligers (zebra mussel larvae) may settle, attach and grow

inside water intake pipes when there is little or no water flow. After the zebra mussels become firmly attached, water flow will not dislodge them. The mussels build up in thick layers until the pipe is clogged or its efficiency is drastically reduced. They can also move up the intake pipe and clog valves, pumps, filters and other parts of the system.

- MOEE provides funding assistance to municipalities for the retrofit of water intakes for zebra mussel control: \$3.7 M was provided in 1991/92, \$3.9 M in 1992/93. Retrofits for the large intakes on lakes Ontario, Erie, Huron and Georgian Bay mostly have been completed.
- Program communications are aimed at increasing public awareness. Eight publications aimed at specific target audiences have been prepared and extensively distributed in an attempt to slow the spread of zebra mussels. Currently, MNR is working in cooperation with the Ontario Federation of Anglers and Hunters (OFAH) which operate a toll free 1-800 information line for public inquiries. A boat wash demonstration project also is being operated in cooperation with OFAH.
- Dramatic changes in water clarity and the abundance of aquatic plants and invertebrates have been observed in Lake St. Clair. Preliminary results on Lake Erie suggest that zebra mussels also have reduced the biomass of algae and some invertebrates, but no changes have been detected in fish populations yet. The abundance of native

clams in Lake St. Clair have been severely reduced by zebra mussels.

- A number of investigations and field tests of non-chemical, low cost, control measures for zebra mussels in cottage intake pipes are now underway. Although none of the systems were 100 per cent effective, preliminary indications are that filter devices provided the best protection from zebra mussels. More related research was funded by the province in 1993.
- The Third International Zebra Mussel Conference was held on Feb. 23-26, 1993, at the Westin Harbour Castle, Toronto. Co-sponsors of the conference were MNR, MOEE, Ontario Hydro, Department of Fisheries and Oceans, Sea Grant and the Electric Power Research Institute. The conference highlighted current research into the biology and impact of the zebra mussel as well as the latest control systems developed to cope with the mussels. The Fourth International Conference will be held in Madison, Wisc., in March 1994.
- The use of chlorine to prevent zebra mussel infestations at water works of industrial and municipal facilities is currently allowed through Certificates of Approval issued by MOEE.

Watershed management plans

MOEE and MNR have continued with the development of a watershed management planning strategy for Ontario's streams, rivers and lake systems. The goals and approach of the

strategy support the integration of water resources planning with land use planning, surface water protection with groundwater protection, and pollution prevention and remediation.

In the past, decisions and direction in land use planning were based on political and/or jurisdictional boundaries. While this approach was functional for land-based activities, it has proved to be less than ideal for water resources planning and stormwater management and has contributed to degraded streams, rivers and lake systems across the province.

MOEE and MNR have jointly developed three documents for use in watershed and subwatershed planning:

- *Subwatershed Planning;*
- *Integrating Provincial Water Management Objectives into Municipal Planning Documents;*
- *Water Management on a Watershed Basis.*

These documents were released in June 1993 for voluntary application in land use and resource management decisions on an interim two-year basis. During this two-year timeframe an implementation steering committee will work with conservation authorities and municipalities as well as affected provincial ministries to refine and further develop the guidelines.

Urban drainage management

MOEE and MNR released the report *Interim Stormwater Quality Control Guidelines for New Urban Development in 1991*. The document advanced a broader approach to the

integration of resource management planning on a watershed basis with municipal land use planning and the use of best management practices, including source controls and site planning and structural facilities such as stormwater retention ponds and filtration basins. These practices and controls will improve stormwater quality and protect aquatic habitats and resources for the public to enjoy.

- In 1991, as the lead agency, MOEE published a technical report entitled *Stormwater Quality Best Management Practices*. This report outlines elements of a BMP selection process; links the integration of BMP planning into the municipal planning process and critiques the performance of BMP design in existing stormwater management facilities.
- A second phase of the best management practices has been initiated to address stormwater management requirements using an ecosystem approach, identifying appropriate control technology, and illustrating how BMP planning and siting will follow the direction specified in watershed plans.

Great Lakes wetlands conservation action plan

The Great Lakes wetlands conservation action plan (GLWCAP) is a federal-provincial initiative in partnership with non-government organizations, including the Citizen's Environment Alliance, Federation of Ontario Naturalists, Great Lakes United, and Nature Conservancy of Canada. The goal of GLWCAP is two-fold:

- to protect the area and function of existing wetlands in the Great Lakes basin;
- to achieve an overall increase in wetland area (30,000 ha.) and function by the year 2020.

The overall strategic plan provides a comprehensive framework for protecting and enhancing wetlands in the Great Lakes basin. The first five-year action plan, in preparation, emphasizes shoreline wetlands along the lower Great Lakes system, north to Severn Sound in Georgian Bay.

In some parts of Ontario south of the Canadian Shield, as much as 95 per cent of the wetland area present at the time of European settlement has been lost. Losses have resulted mainly from drainage for agriculture, but also from drainage and filling for urban development and other purposes. Recreational development, especially of marinas, is putting increasing pressure on shoreline wetlands in both northern and southern Ontario. Although conversion to other uses is the most serious threat to wetlands in the Great Lakes basin, pollution, siltation, and excessive water level regulation by human actions has reduced the natural functions of many wetlands.

While there is no comprehensive inventory of wetlands in the Great Lakes basin, an evaluation program for wetlands larger than two hectares has been underway since the early 1980s in the area south of the Canadian Shield. To date, approximately 2,000 wetlands have been evaluated by MNR. It is estimated that a similar number remain to be evaluated in this area.

- There are approximately 160-170 coastal wetlands (i.e. those directly linked to the Great Lakes or connecting channels) in the areas covered by GLWCAP's first five-year action plan. Of these, 142 have been evaluated and approximately 20 small wetlands remain to be evaluated.

Some of Ontario's wetlands are protected as part of other protected lands such as provincial parks and national wildlife areas. The most significant protection for wetlands in Ontario results from the proclamation in June 1992 of the Wetlands Policy Statement for Ontario under Section 3 of the *Planning Act*. Under this policy, municipalities and other planning bodies are required to have regard for provincially significant wetlands in their land use planning activities.

- About 80 per cent of the area and 50 per cent of the number of the evaluated wetlands in southern Ontario will be protected under this policy.
- Along the Great Lakes shoreline 97 per cent of the area and 72 per cent of the number of the evaluated wetlands will be protected under this policy.

Wetlands are being protected through programs which work in cooperation with the GLWCAP such as the eastern habitat joint venture of the North American waterfowl management plan (NAWMP). The goal of NAWMP is to restore waterfowl numbers to levels that existed in the 1970s. Securing important wetland breeding and staging areas is one component of the plan. This is occurring at various levels ranging

from acquisition to handshake protection agreements with landowners.

Waterfront Regeneration Trust

On June 25, 1992, the Waterfront Regeneration Trust was established as an agency of the provincial government. The Trust will build on the work of the Royal Commission on the Future of the Toronto Waterfront by working with others toward implementing the commission's recommendations.

Some highlights of the Trust's work include working with others to:

- establish a waterfront trail or greenway from Burlington Bay to the Trent River;
- coordinate programs and policies of the Ontario government relating to waterfront lands;
- make recommendations regarding transportation, housing, environment and jobs in the Garrison Common area (including Exhibition Place and Ontario Place);
- address soil contamination problems, flooding concerns and preservation of the natural and built environments of the lower Don River area, including Ashbridge's Bay and the Leslie Street Spit;
- improve public transportation along the central waterfront;
- assist in establishing partnerships among government agencies and encouraging private sector development.

V *Binational activities*

■ *Lake Superior binational program*

■ *Niagara River toxics management plan*

■ *Lake Ontario toxics management plan*

■ LAKE SUPERIOR BINATIONAL PROGRAM

In September 1991, at the International Joint Commission's biennial meeting in Traverse City, Mich., the signatories to the Great Lakes Water Quality Agreement (Canada and the United States) announced a new program for Lake Superior. The program was developed in response to the IJC's challenge in 1989 to use Lake Superior as a zero discharge demonstration area for persistent toxic and bioaccumulative substances. At that time, the province was developing a number of initiatives (such as MISA) which would achieve virtual elimination of persistent, toxic, and bioaccumulative substances province-wide. MOEE staff were instrumental in shaping the binational program as presented to the IJC at the biennial meeting in 1991.

The binational program to restore and protect Lake Superior is divided into two critical components. First, the zero discharge demonstration program is in direct response to the IJC call for the demonstration of zero discharge of persistent toxic substances into Lake Superior.

The second component of the binational program is the broader program to restore and protect the Lake Superior basin. This component is built upon, but not limited to, the development of a lakewide management plan (LaMP) as defined under the 1987 Great Lakes Water Quality Agreement ("Parties...shall develop and implement lakewide management plans for open lake waters.... Such plans shall be designed to reduce

loadings of critical pollutants in order to restore beneficial uses"). In addition to considering the critical pollutants in the Lake Superior basin, the program will examine the impact of the introduction of exotic species, hydro-electric developments and the destruction of habitats. Ultimately this component of the program is to provide a broadly based basinwide management plan oriented to the ecosystem.

With respect to the zero discharge demonstration program, the province has participated in this first component by building upon two program areas: pollution prevention and controls and regulation. For example:

- Clean water regulations under MOEE's municipal and industrial strategy for abatement for the pulp and paper sector were released for public review Feb. 2, 1993. These regulations incorporate the Lake Superior binational program goal of zero discharge of persistent toxic chlorinated organics (a component of adsorbable organic halides (AOX)) from Ontario's kraft mills by Dec. 31, 2002.
- Since January 1991, loadings of AOX from kraft mills discharging into Lake Superior have been reduced by at least 50 per cent. The cost of achieving this result, estimated to be \$100 million, was borne by three major companies in the basin in anticipation of the new MISA regulations.
- MOEE has matched federal funds for a chlorine-free bleaching demonstration project for Domtar's Red Rock pulp and paper mill.

This project has provided viable alternatives to the use of chlorine in Domtar's mills across Canada.

- The concept of zero discharge for certain pollutants is an important component of MOEE's pollution prevention activities. MOEE has been participating in a basinwide dialogue on voluntary pollution prevention strategies with Lake Superior pulp and paper industries and will investigate opportunities for participating in a basinwide dialogue with the mining sector in 1993/94.
- MOEE is the lead agency in the development of options for the removal and/or treatment of contaminated sediments at the Northern Wood Preservers site in Thunder Bay. The ministry is acting in partnership with the federal Department of the Environment (DOE), Abitibi-Price, Canadian National Railway and Northern Wood Preservers.

Ontario has contributed directly towards the development of a basinwide management plan for Lake Superior through the following activities:

- MOEE has coordinated the collection of data on sources and loadings of nine critical chemicals, identified information gaps in data, and is preparing an assessment of Lake Superior water quality for public distribution;
- MNR currently leads a sub-committee of the Superior working group which has drafted ecosystem objectives for the Lake Superior basin and is coordinating input

from other agencies to develop quantitative indicators;

- MNR is assessing the status of the bald eagles and peregrine falcons on the Lake Superior shoreline. This information will be used to determine the suitability of these species as an indicator of environmental health for the north shore.

Ontario also has contributed towards the development of a basinwide management plan indirectly through participation in other ongoing programs and initiatives.

- In addition to providing \$686,000 since 1991 for the development of the four north shore Canadian RAPs, MOEE provided additional resources to accelerate the development of the four Canadian Lake Superior Stage I RAP reports.
- MNR has contributed approximately \$600,000 in support of the Lake Superior RAP program.

To ensure the requirements of a lakewide management plan are met for Lake Superior, the province has provided coordination and leadership through MOEE for identifying the process for designating critical pollutants, assessing ecosystem health and developing a timetable for drafting a Stage I LaMP. MNR has provided support for the broader habitat and land use planning issues that will arise out of this ecosystem-based management plan. Further, Ontario has assigned technical and scientific staff from both MOEE and MNR to work on the development and implementation of the binational program, in areas such as planning, timber policies, fisheries management and

research and toxic chemicals. MOEE also provides financial support to the Lake Superior binational forum, an advisory group representing many individuals or groups which have an interest in or are directly affected by the program.

In summary, Ontario has taken responsibility for coordinating various aspects of the program where it has expertise, has provided data and resources where feasible and has proactively initiated and implemented programs and policies which contribute to achieving the zero discharge of persistent, toxic and bioaccumulative substances in the Lake Superior basin.

■ NIAGARA RIVER TOXICS MANAGEMENT PLAN

The Niagara River point source monitoring program has been monitoring municipal and industrial point source discharges from 1981 to present.

In 1987, the United States Environmental Protection Agency (USEPA), the New York State Department of Environmental Conservation (NYDEC), Environment Canada and the Ministry of Environment and Energy signed the Declaration of Intent which calls for a significant reduction of all toxics, and a specific recommendation for 50 per cent reduction of 18 targeted chemicals, to the Niagara River. The year 1986 was selected as the baseline for comparison, and 1996 the year for achievement of the reduction. The Declaration of Intent, together with the associated workplans, were the

basis of the Niagara River toxics management plan (NRTMP).

- Initial data collected under the monitoring program between 1982 and 1986 showed reductions in discharges of toxics of about 80 per cent for the targeted chemicals (chemicals of concern or COCs) by both Ontario and the U.S.
- For the period between 1986 and 1991, there has been a general trend toward the further reduction in loadings or deposits of COCs from Ontario discharges to the Niagara River.
- As a result of further improvements or upgrades of landfills and discharge points, by the 1991 monitoring year a further reduction of 83.2 per cent of loadings was achieved for all targeted chemicals. Of this total, industrial facilities reduced their loadings by 55.6 per cent and municipal facilities by 89.8 per cent.

In addition to the point source monitoring program, MOEE has been conducting biomonitoring studies in support of the NRTMP routinely since 1981. Freshwater indigenous mussels from an uncontaminated area are caged in the river at areas of suspected contamination. The mussels are analyzed at the end of the exposure period to determine the amount of contaminants they have accumulated. This has proven to be a successful technique to identify sources of contamination to the Niagara River.

- The 1991 survey of 25 sites detected the presence of several chlorinated benzenes, PCBs, organochlorine pesticides and polychlorinated dioxins and furans at most of the 16 sites on the American side of the river. Low levels of organochlorine pesticides and trace concentrations of PCBs, most likely from historic sources,

were found at three of nine sites sampled on the Canadian side.

- The main sources of contamination were traced to Pettit Flume Inlet Cove and Two Mile Creek in Tonawanda, and in the Niagara Falls, N.Y. area, to the 102nd Street landfill site, several sites in the vicinity of Occidental Chemical Corporation's Buffalo Avenue plant, and to Gill Creek, all on the U.S. side of the river.

Data from these studies are used by MOEE staff to assist in developing requirements for facility abatement and river remediation as well as to provide input to international negotiations for cleanup.

Ontario has met the NRTMP goal of a 50 per cent reduction in toxics loadings from point sources to the Niagara River. Water quality, biological and source monitoring will continue.



LAKE ONTARIO TOXICS MANAGEMENT PLAN

The LOTMP is a four-party plan of action for reduction and eventual elimination of persistent toxic substances in Lake Ontario. Signed by the USEPA, Environment Canada, MOEE and NYSDEC in 1989, an update in 1991 focused increasing attention on pollution prevention.

Through review of existing information on contaminant levels in water, fish, and other aquatic organisms, nine persistent toxics were identified as exceeding the most stringent four-party standards and criteria. Efforts are directed to reductions in loadings of these substances to Lake Ontario.

- Loadings to Lake Ontario from the Niagara River of the nine identified substances decreased from 7.47 kg/day in 1989 to 1.52 kg/day in 1991.

MOEE participates fully in implementing the LOTMP through a number of existing programs including:

- MISA
- RAPs (there are four Lake Ontario RAPs, plus the Niagara River)
- Pollution prevention
- Great Lakes investigations and surveillance
- Drinking water surveillance

Through the MISA program, MOEE has a primary role in the regulation of direct discharges to Lake Ontario.

- The Clean Water Regulation for the petroleum refining sector was promulgated in 1993, affecting two

facilities on Lake Ontario.

- A draft clean water regulation for the pulp and paper sector, affecting eight plants in the Lake Ontario basin, is expected to be promulgated in 1993.
- On Sept. 13, 1993, the draft effluent limits regulation for the metal mining sector was released for public review and comment. The regulation will affect 32 mines and refineries in Ontario that produce base metals such as nickel, zinc, iron and gold. The regulation will reduce by 40 per cent discharges of copper, lead, nickel, zinc, cyanide and arsenic and reduce total suspended solids by 23 per cent. Reductions in regulated contaminants should lead to reductions in other substances such as aluminium, chromium, cobalt and iron.
- Draft clean water regulations for the industrial minerals and metal casting sectors are expected to be released for public review and comment by October 1993, affecting six facilities, and one facility, respectively.

Under the RAP program, detailed plans for cleanup of degraded sites and control of sources are being developed. RAP areas are Hamilton Harbour, Metropolitan Toronto and Region, Port Hope and Bay of Quinte.

- The Hamilton Harbour Stage II report detailing recommended remedial actions was completed in February 1993. More than three-quarters of the recommendations already are being implemented. Considerable attention is being

given to control of toxic and conventional pollutants from urban stormwater sources. MOEE has invested more than \$10 million in recent years in implementing pollution reduction measures in Hamilton, including process audits and optimization studies at the Hamilton and Dundas STPs, construction of two CSO detention tanks, and dredging and disposal of sediments from the Windermere Basin.

- In recent years MOEE, in association with the Metro Toronto municipality, has undertaken a \$500,000 investigation of discharges of toxic substances to the Toronto waterfront. This state-of-the-art investigation has pinpointed sewage discharges and stormwater discharges of particular concern. The ministry is working jointly with local municipalities to track down and control sources of toxic substances from this highly urbanized area. Further cooperative work is proceeding on modelling the sources and impacts of pollutants to the Toronto waterfront. The Stage II report for Metro Toronto is expected in 1993.
- In the Bay of Quinte AOC, Domtar Packing is seeking approval to install two evaporators in order to evaporate excess process water and to improve the quality of the effluent it discharges to the Trent River. Domtar Wood Preserving in Trenton built a activated carbon filter system in 1991 to treat effluent. A tertiary treatment system is in the design stage for the Trenton STP. Additional sludge storage

tanks are being built at the Belleville STP, which will improve sludge-liquid separation and thereby improve effluent quality. A process audit is commencing at the Belleville STP to determine optimal hydraulic capacity.

- The quality of effluent discharged by Cameco (Eldorado Resources Ltd.) in Port Hope is in compliance with the monthly objectives set by AECL for uranium, ammonia, fluoride, and nitrate. Cameco will be subject to the MISA mining sector regulations. It is not expected that the Stage II report for Port Hope will include a recommendation for further effluent control at Cameco. The issue is essentially sediment remediation.

MOEE routinely conducts environmental investigations in the nearshore areas of Lake Ontario including:

- sediment chemistry in RAP sites to analyze biological impacts of toxics;
- regular and enhanced tributary monitoring;
- localized water quality assessments (e.g. St. Catharines, Hamilton, Toronto, Oshawa);
- long-term and integrated assessments of contaminant levels in sed-

iments, water column and biological organisms to determine any emerging problems (every four years in Lake Ontario);

- ongoing biological monitoring to determine long-term trends, spatial distribution of contaminants and public health advisories (e.g. sport fish contaminant monitoring program and young-of-the-year fish contaminants monitoring program);
- monitoring 11 drinking water treatment plants in Lake Ontario to monitor compliance with Ontario drinking water objectives (drinking water surveillance program). MOEE cooperates with municipalities to analyze both raw and treated drinking water for a wide range of pollutants including toxic substances. All drinking water supplies from Lake Ontario water treatment plants regularly comply with applicable standards for drinking water.

Results from these monitoring activities provides current information on contaminant levels in Lake Ontario water, fish and biota, to assess the effectiveness of efforts directed towards reductions in loadings.

The Lake Ontario toxics committee, currently renamed the Lake Ontario Secretariat, is responsible for

monitoring implementation, progress reporting and plan revision. As a member of the Four Party Lake Ontario Secretariat, MOEE is also contributing to several cooperative efforts, specific to the LOTMP, including:

- a revised analysis of data on toxics in the lake and categorization of Lake Ontario toxics;
- development of strategies for chemical-specific toxics reduction;
- compilation of loadings data;
- development of ecosystem objectives;
- modelling of the movement of toxics in the lake ecosystem;
- continuous review and updating of water quality objectives.

A new update to LOTMP is to be released by the end of 1993. In addition, the decision has been made to expand LOTMP into a lakewide management plan for critical pollutants, as called for under the Great Lakes Water Quality Agreement. The ministry provides essential information on sources and impacts of a wide range of substances beyond those addressed under the LOTMP (e.g. phosphorus, sediment, bacteria).

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VI Appendix I

■ GREAT LAKES FACTS

These great bodies of water took their most recent form almost 10,000 years ago, at the end of the last ice age. Formed during a span of two million years by glacial and geological action, lakes Superior, Michigan, Huron, Erie and Ontario are joined by four connecting channels to form the largest surface freshwater system in the world. They are a treasured global resource, holding 20 per cent of the world's supply of surface freshwater.

The waters of the Great Lakes are important for many purposes—domestic uses (residential, commercial, institutional); industrial processes; agricultural operations (irrigation and livestock watering); electric power generation (fossil fuel, hydroelectric, and nuclear); navigation; sanitation; recreation; and habitat for aquatic life. Approximately 2.5 trillion litres are used per day. Almost 97 per cent of this amount is returned to the system; the remaining three per cent leaves the system either through evaporation or through incorporation into products and is considered consumed.

Approximately 25 million people obtain their drinking water from the Great Lakes. An average of 20 billion kilowatt hours of electricity are generated annually by using Great Lakes water. Many industries first developed near the lakes because of the availability of abundant water supplies and because they were a means of

accessible, efficient transportation.

The economic importance of the Great Lakes basin is clearly shown by the following:

- an estimated 45 per cent of Canadian manufacturing and 17 per cent of U.S. manufacturing is located in the Great Lakes basin;
- at least 72 per cent of Canadian and 70 per cent of U.S. steel production occurs in the Great Lakes basin;
- more than 90 per cent of Canadian car and truck production and 41.5 per cent of U.S. cars and 37.3 per cent of U.S. trucks and buses are manufactured in the Great Lakes region;
- Ontario commercial fishers caught 24.5 million kg (54 million lbs.) in 1990; the dockside value of the fish caught was about \$42 million.

Industrial, municipal, and recreational use of the Great Lakes has imposed great stress on the ecosystem. Pollutants include: toxic substances in water, sediments, fish, and other organisms living in or depending on the water; elevated levels of bacteria; and high levels of phosphorus and other nutrients. Pollutants are distributed through point sources, such as direct discharges of effluent through man-made pipes and sewers, and nonpoint sources, such as urban runoff, rural land runoff, atmospheric deposition and groundwater migration from waste disposal sites and landfills.

The Canada-U.S. Great Lakes Water Quality Agreement, signed by Canada and the United States in 1972, and amended in 1978 and 1987, is the principal vehicle for ensuring a coordinated, binational approach to water quality management in the international Great Lakes basin. Its purpose is to "restore and maintain the chemical, physical, and biological integrity of the Great Lakes basin ecosystem". This is to be accomplished by the signatory governments developing programs, practices and technology necessary for a better understanding of the basin ecosystem and by eliminating or reducing "to the maximum extent practicable" pollutant discharges into the Great Lakes system.

The Canada-Ontario Agreement Respecting Great Lakes Water Quality (COA) has been the principal mechanism for facilitation of federal-provincial cooperation to address Canada's obligations under the Canada-U.S. Great Lakes Water Quality Agreement. First signed in 1971, and renewed in 1976, 1982, and 1986, COA expired on March 31, 1991. It was extended on an interim basis to March 31, 1993. The government of Ontario remains strongly committed to the protection of the Great Lakes as it continues to negotiate with Canada for a new agreement.

VII Appendix II

■ RAP HIGHLIGHTS FOR INDIVIDUAL AREAS OF CONCERN

The following are selected highlights of restoration and rehabilitation activities in areas of concern:

Thunder Bay

- Several highly successful habitat restoration projects have been undertaken in the Thunder Bay area of concern, including the provision of spawning and nursery habitat for migratory salmonids. Included are projects on: the Current River, the Neebing McIntyre Floodway, McVicar Creek, the Kaministiquia River and McKellar River.
- In June 1993, the RAP public advisory committee (PAC) carried out a most successful community shoreline cleanup in Thunder Bay. Wake Up Your Waterfront attracted 2,500 volunteers and \$63,000 in

donations of cash and services by local businesses and industries. During a two-day period, enthusiastic volunteers scoured more than 125 km of shoreline in the Thunder Bay area.

- The city of Thunder Bay is committed to upgrading its sewage treatment plant. Funds are currently being set aside to proceed with this major project in the next few years. MOEE provided \$3.0 million in grants in 1992/93, and has allocated \$1.6 million for 1993/94.

Nipigon Bay

- A water management plan is underway for the Nipigon River, with cooperation from Ontario Hydro, provincial and local agencies. This follows a very successful restoration of the Nipigon Bay habitat and fishery, involving the transfer of 15,000 adult walleye.

Spanish Harbour

- MOEE announced in 1993 that the jobs Ontario capital fund will provide \$3.5 million for the expansion and upgrading of the town of Espanola wastewater treatment plant (WWTP), replacing an existing primary plant discharging to the Spanish Harbour. An additional \$4.8 million will be provided by MOEE for the water treatment plant and elevated storage reservoir.

Severn Sound

- One of three RAPs that have submitted a Stage II report to the federal and provincial governments, the Severn Sound RAP is at the forefront of implementation. New and upgraded sewage treatment plants will reduce a controllable source of phosphorus to Severn Sound. The village of Elmvale's new water pollution control plant



(WPCP) project and the upgrading of the town of Penetanguishene Main Street and Fox Street WPCPs projects have received approval and provincial funding, in part, under Ontario's jobsOntario capital program (provincial contribution is \$6.6 million for Elmvale, \$2.2 million for Main Street, and \$0.4 million for Fox Street). Once completed and operating in 1994, the phosphorus load from the Elmvale effluent will be cut by 97 per cent. More than 60 per cent of the phosphorus deposited to Penetang Harbour is from the Main and Fox Street WPCPs. The Penetanguishene projects will result in a significant decrease in phosphorus concentrations and nuisance algae in the open waters of Penetang Harbour and will go a long way to meeting RAP objectives for restoring these waters.

- Tributary rehabilitation is well underway in the Severn Sound's streams and rivers. Led by MNR, and in cooperation with the Wye Marsh Wildlife Centre, work carried out includes 24 km. of fence on stream banks to restrict access to 576 cattle. Thirty-four thousand trees have been planted in the buffer strips. These and other projects control erosion and restore aquatic habitats. Ontario is supporting tributary rehabilitation through a \$200,000 jobsOntario capital grant.

Collingwood Harbour

- The first Canadian RAP to submit a Stage II report to the IJC, the Collingwood Harbour RAP is a highly-regarded initiative supported by the local community. Emphasis has been placed on educating the community on the environmental significance of water conservation and the use of environmentally benign products. The newly implemented Greening of Collingwood project involves the entire community in reducing water and energy consumption, waste, and the generation of hazardous household waste. One of the most exciting projects designed to raise public awareness is the environmental theme park: ENVIRO-PARK. Developed to educate young people on how to protect our aquatic environment, play structures have been constructed which represent agricultural, residential, commercial, and industrial water uses.
- Water quality in the harbor has improved dramatically during the last five years due to noteworthy improvements in the WWTP operation (\$200,000 in MOEE funds), and process changes at local industries, such as the recirculation of cooling water at Canadian Mist Distilleries. Virtually all the recommended remedial actions have been implemented, and all the delisting targets recommended in the Stage II report have been either

met or are anticipated to be achieved in the near term. Collingwood Harbour is well on the road to full recovery.

Hamilton Harbour

- The second RAP to submit their Stage II report to the governments of Canada and Ontario, the Hamilton Harbour RAP, in cooperation with the Royal Botanical Gardens, is well underway toward implementation. Habitat restoration plans have been almost completed for many major projects. A large waterfront park has been developed in the west end to capitalize on improved water quality conditions. Ontario is supporting habitat restoration through a \$2 million jobsOntario capital grant.
- Hamilton-Wentworth Region, with provincial beaches and jobsOntario funding totalling more than \$4 million, recently has completed two large combined sewer overflow retention basins to protect sensitive recreational areas from sewer overflows in the far west end of the harbor.

Metropolitan Toronto and Region

- The Metropolitan Toronto and Region RAP is planning to release its Stage II report in 1993. Pilot habitat restoration projects, led by the Metro Toronto Region Conservation Authority and MNR, were initiated at five locations across the Toronto waterfront in

1992, the first year of a three-year initiative. The techniques demonstrated included wetland creation, fish reef construction and the reconnection of a pond to Lake Ontario. The total value of all the projects during the three years is estimated at \$600,000.

- With provincial funding assistance, the city of Toronto constructed a combined sewer overflow (CSO) and stormwater detention tank in the eastern beaches area in summer 1991. The tank is providing improved protection for the beaches and the city is proceeding with the construction of a second tank (\$10 million) to provide a higher degree of protection. The city also is proceeding with the implementation of the second phase of its sewer system master plan, the installation of a storage tunnel along the western beaches (\$60 million) to virtually eliminate CSO and control stormwater runoff.

Port Hope Harbour

- Radioactive contaminated sediments from the Port Hope Harbour will have to be disposed of in a low level radioactive waste management facility licensed by the Atomic Energy Control Board. At this time, no such facility exists in Ontario that is capable of receiving the quantity of material from the harbor. A siting task force was formed to establish a low level radioactive waste management facility in Ontario.

- The siting task force presently is designing detailed environmental, economic and technical studies of a potential site in a volunteer host community. Water quality and sediment contaminant monitoring is conducted on an ongoing basis and in 1993, Health and Welfare Canada is conducting a comprehensive health risk assessment in the Port Hope area. Several cleanup options for the harbor are under active consideration.

Bay of Quinte

- In 1992 and throughout 1993, actions for remediation included a stormwater quality management program, a rural water quality initiative, a rural beaches assessment, the town of Deseronto and Mohawks of the Bay of Quinte water conservation project, improvements to agriculture practices on Cold Creek and work to develop a strategy for wetland and fish habitat protection and rehabilitation.
- Many future activities for water quality improvement are planned: the upgrade of the Trenton sewage treatment plant to tertiary treatment, a Blue Box 2002 curbside recycling program and possible expansion of the Canadian Forces Base Trenton STP. Plans to decommission the Prince Edward Heights STP were finalized.

St. Marys River

- One of three binational RAPs shared with the state of Michigan, the St. Marys River RAP is led by Ontario. Pilot site projects are underway in the AOC aimed at addressing contaminated sediments. Discussions are presently underway to review the potential treatment of contaminated sediments in the Algoma Steel boat slip. Agreement in principle for this project has been reached by MOEE, Environment Canada, Waste Water Technology Centre, the city of Sault Ste. Marie and Algoma Steel Inc.
- The Algoma Steel plan of arrangement (with creditors) and the amending Control Order (with MOEE) commits Algoma Steel to \$45 million in environmental improvements by 1996.

St. Clair River

- This binational RAP, led by Ontario, is coordinated in conjunction with Michigan Department of Natural Resources. The Ministry of Natural Resources has developed habitat restoration plans for two sites; the Chenal Ecarte/Syndenham marsh and the area between the Dupont plant and the river.

Detroit River

- This binational RAP is led by the Michigan Department of Natural Resources in conjunction with MOEE. Under the Binational Letter of Intent, Michigan and Ontario are moving in cooperation on an extensive technical and consultative process to develop the RAP Stage II report.
- The city of Windsor and MOEE continue to cooperate on improvements to the Windsor sewage treatment facility and control actions on stormwater and combined sewer overflows.
- The city of Sarnia completed a comprehensive pollution control planning (PCP) study which provides the municipality with an implementation plan to upgrade the existing primary sewage treatment plant and abate combined sewer overflows.

Niagara River

- This interconnecting channel RAP has separate Canadian and American RAP teams and PACs. Ontario has taken a strong approach to reducing point sources discharges to one of Ontario's natural wonders. Several industrial point sources have been eliminated or have had treatment upgrades in recent years.
- The regional municipality of Niagara, with funding assistance from the province of Ontario, has upgraded treatment at the Fort Erie, Niagara Falls, and Welland sewage treatment plants and installed collection and treatment facilities at Queenston.
- The city of Niagara Falls committed approximately \$3 million for implementation of sewage works. The regional municipality of Niagara is currently designing the upgrades to the Stamford Ave. sewage treatment plant at a total capital cost of \$15 million.

St. Lawrence River

- The St. Lawrence River RAP has separate Canadian and American RAP teams and PACs. With federal and provincial partnership funding, the city of Cornwall has initiated a pollution control planning study to evaluate cost effective solutions to correct its combined sewer overflow problems and provide improved sewage treatment. As part of the St. Lawrence habitat rehabilitation projects, the St. Lawrence RAP team is evaluating options to rehabilitate and manage Lake St. Francis wetlands and fish habitat using federal and provincial partnership funding. The RAP team and PAC are working intensively on the assessment of remedial options.

VIII Appendix III

GLWQA ARTICLES AND ANNEXES ADDRESSED BY PROVINCIAL PROGRAMS

INITIATIVE/ACTIVITY	GLWQA REFERENCE
MISA direct industrial discharges	Article VI,#1(b)
MISA sewer use control program/ sewage treatment plants (STPs)	Article VI,#1(a)
Infrastructure funding	Article VI,#1(a)(ii)
Ontario Clean Water Agency	Article VI,#1(a)
Performance: Operation of direct industrial dischargers and sewage treatment plants	Article VI,#1(c)
Remedial action plans (RAPs)	Annex 2,#1-4
Pollution prevention	Annex 10, 12
Provincial water quality objective development	Article IV,#1(a),(b) Article V,#1 Annex 1
Provincial sediment quality guidelines	Annex 7, 14
Lakefilling guidelines	Annex 14
Clean up rural beaches (CURB) program	Annex 13
Urban beaches program	Article VI,#1(v) Annex 13
Monitoring and surveillance (including ambient water, sediment biota, drinking water, sport fish, spottail shiners)	Annex 11
Air quality monitoring in the Great Lakes basin	Annex 15
Emergency spills response	Annex 8, 9
Enforcement	Article VI,#1(a)(vi) Article VI,#1(b)(vii) Article VI,#1(f)(v) Annex 8,#2(a)
Research	Annex 17
Provincial agricultural activities	Annex 3, 13
Status of fish stocks in Ontario waters	Annex 11
Zebra mussel program	Annex 6,#1(b) Annex 17:#2(i)
Watershed management plans	Annex 13
Urban drainage management	Annex 13
Great Lakes wetlands conservation action plan	Annex 13
Binational Activities (Lake Superior program, Niagara River and Lake Ontario toxics management plans)	Annex 2,#5-6

Figure 1: The number of days on which monitored beaches were placarded for the period from 1988 to 1992

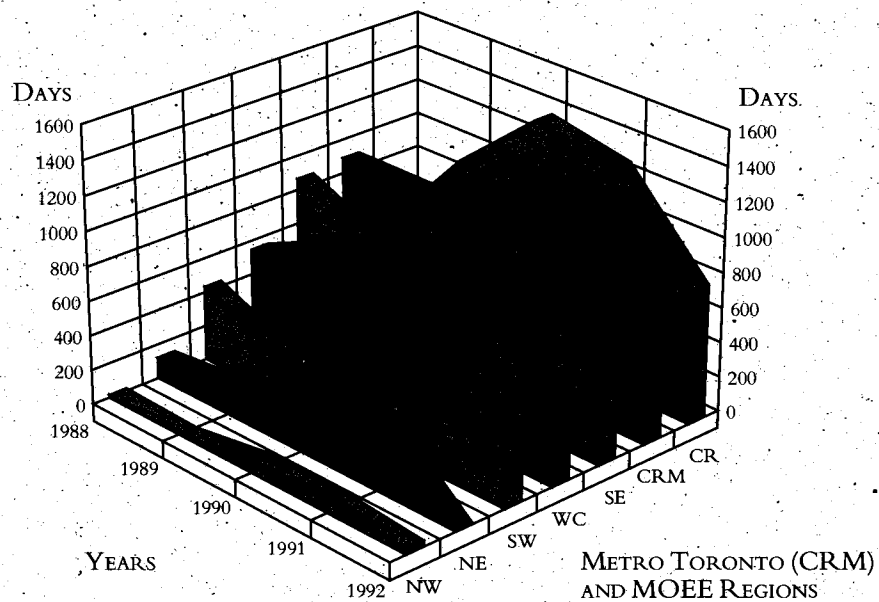
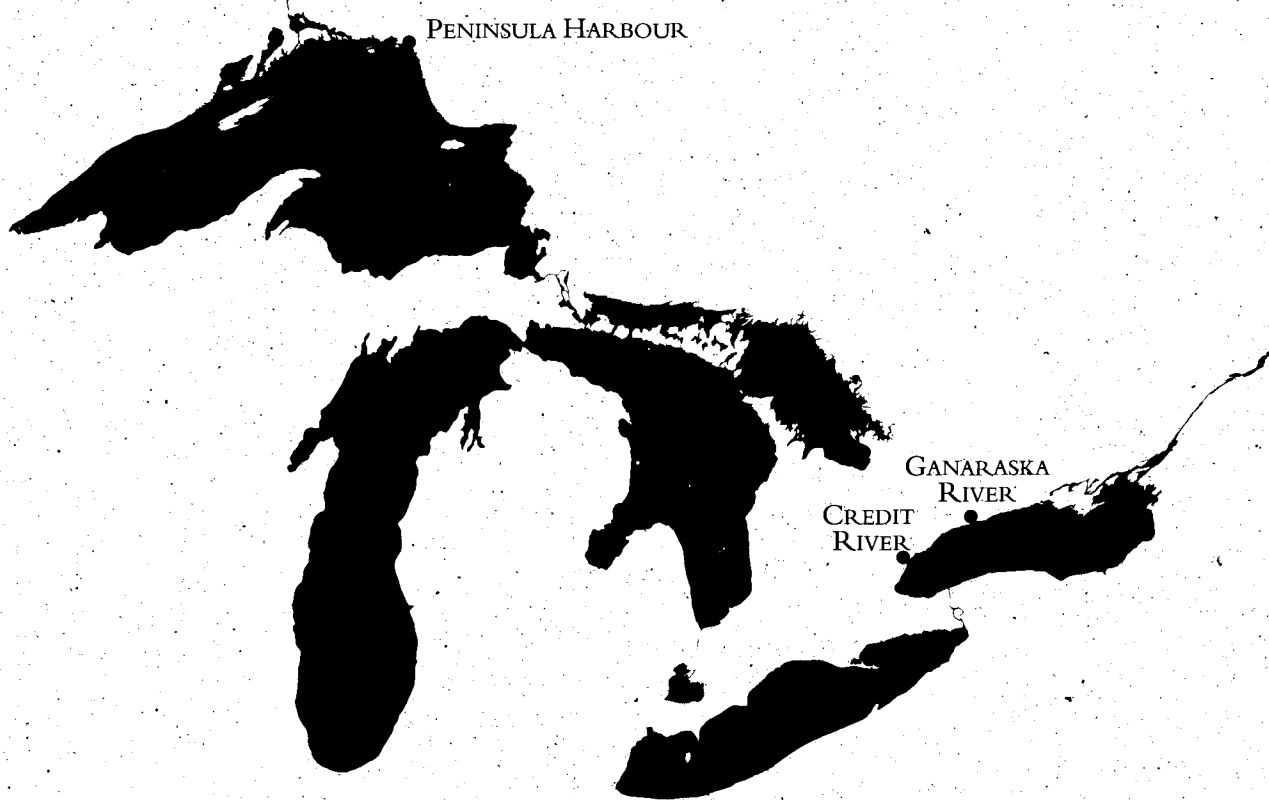


Figure 2: Drinking water surveillance program monitoring sites on the Great Lakes



Figure 3: PCB and mirex trends in Great Lakes sport fish, 1970s - 1990s



CREDIT RIVER COHO SALMON

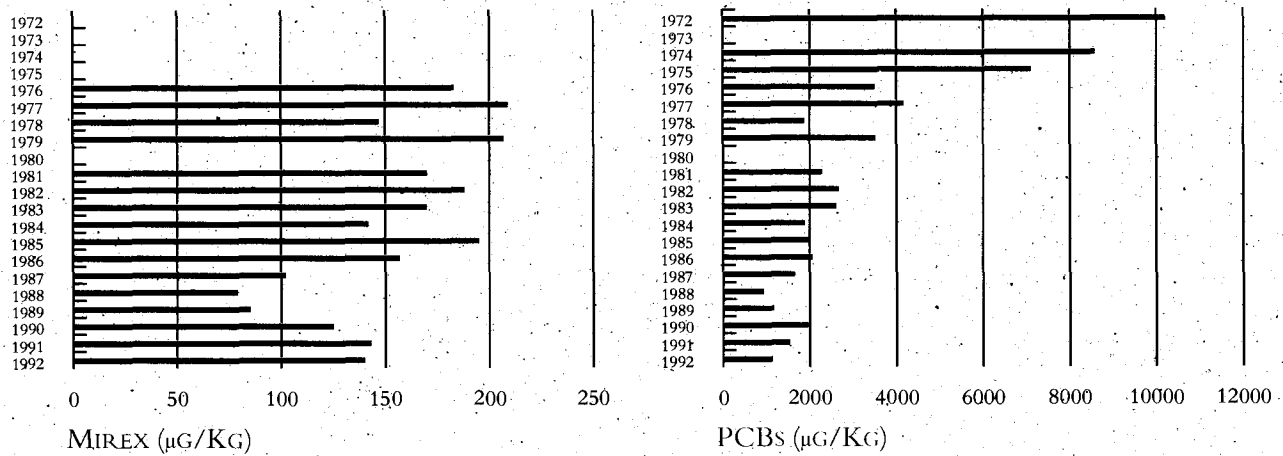
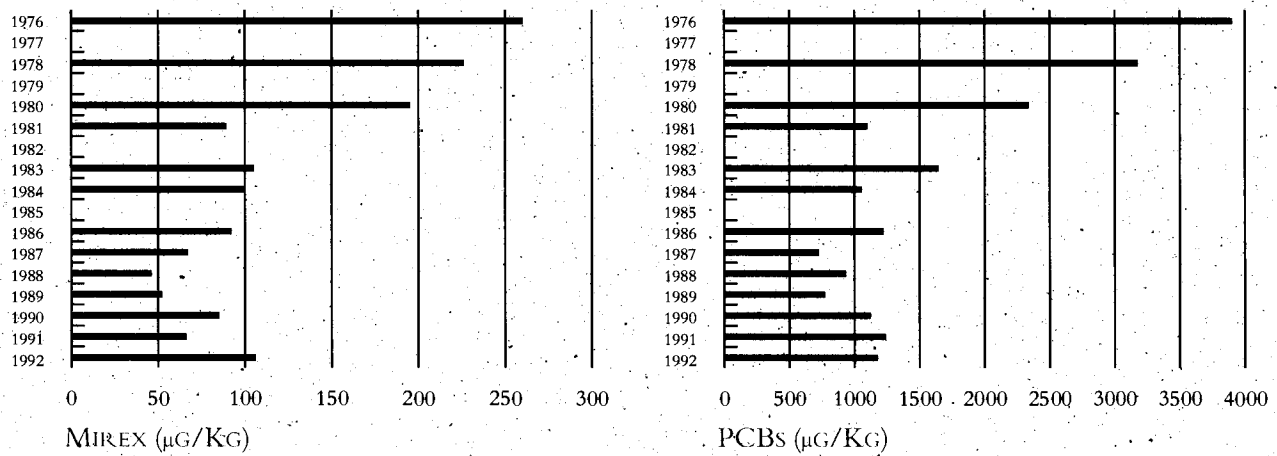


Figure 3: Continued

GANARASKA RIVER RAINBOW TROUT



PENINSULA HARBOUR LAKE TROUT

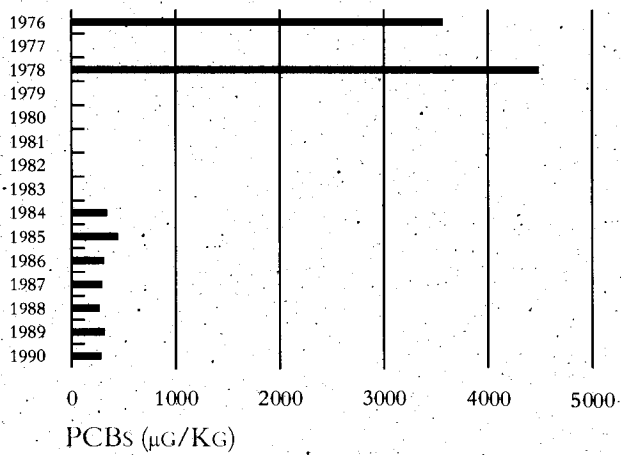


Figure 4: Total PCB concentrations in young-of-the-year spottail shiners (1990 - 1991)

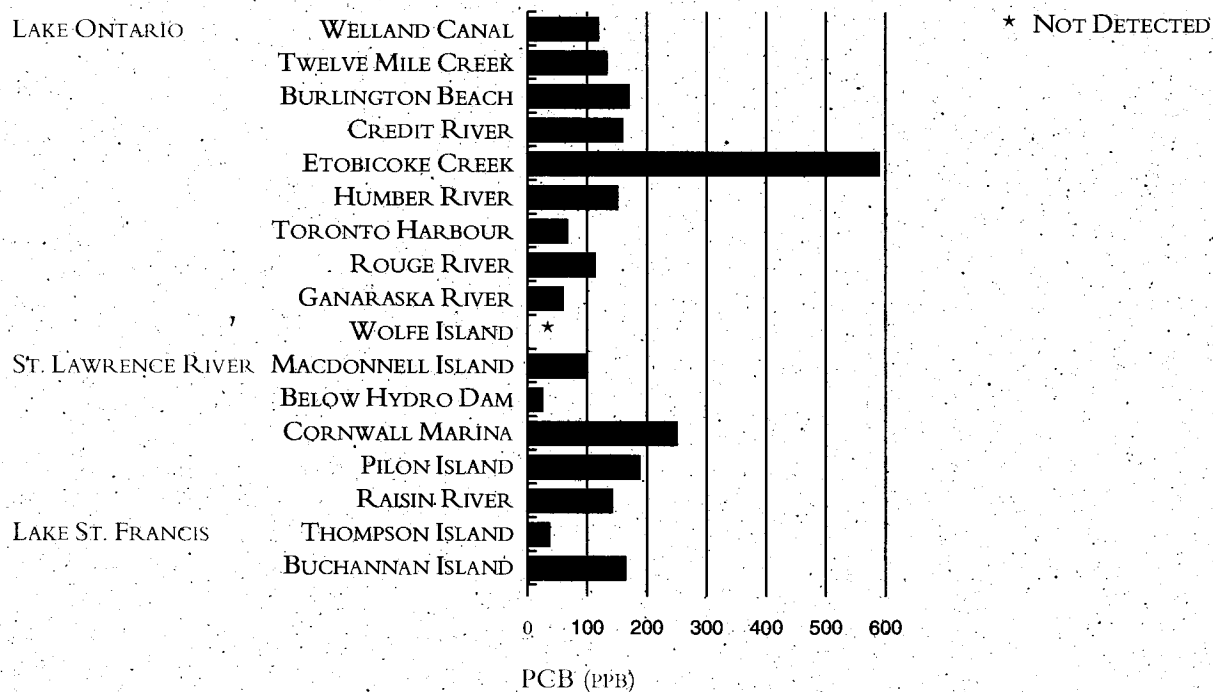
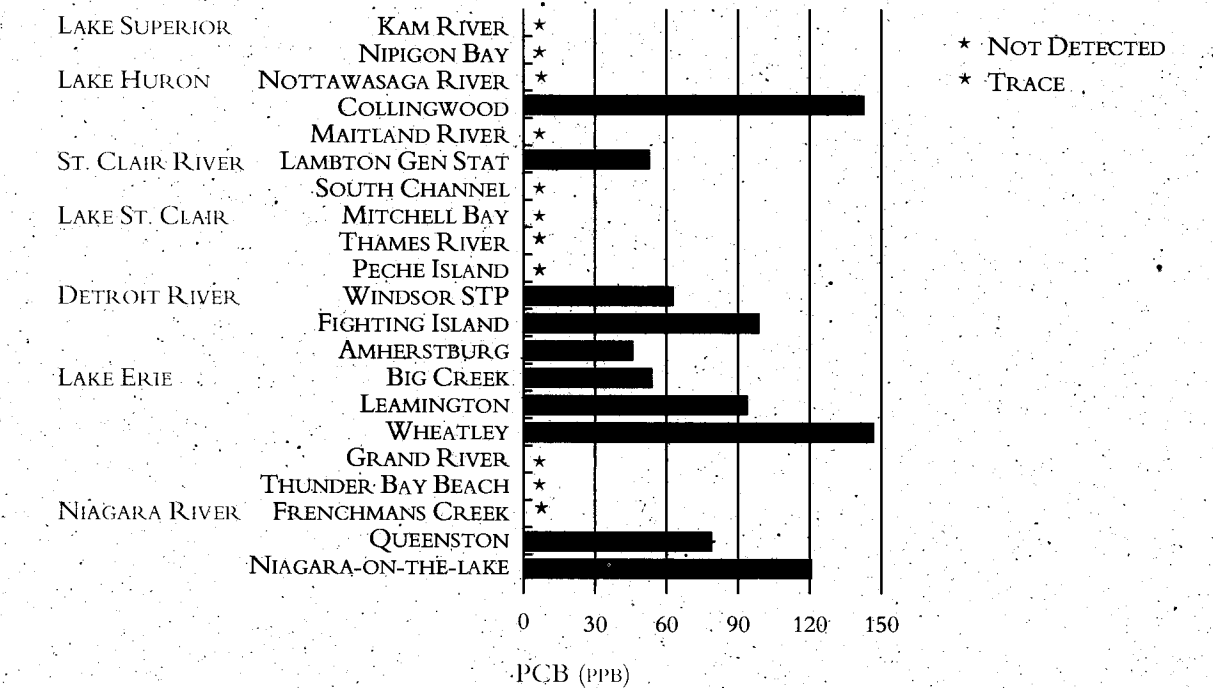
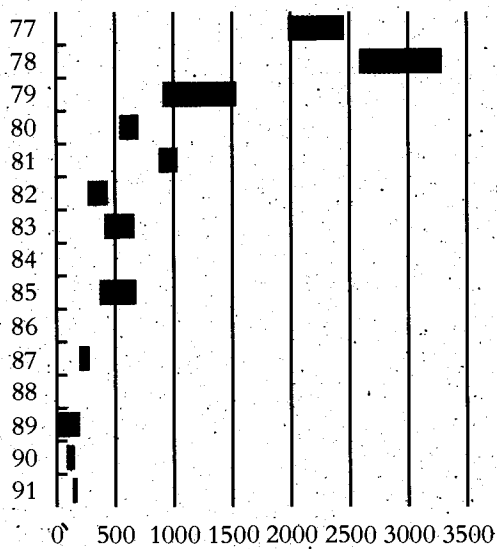
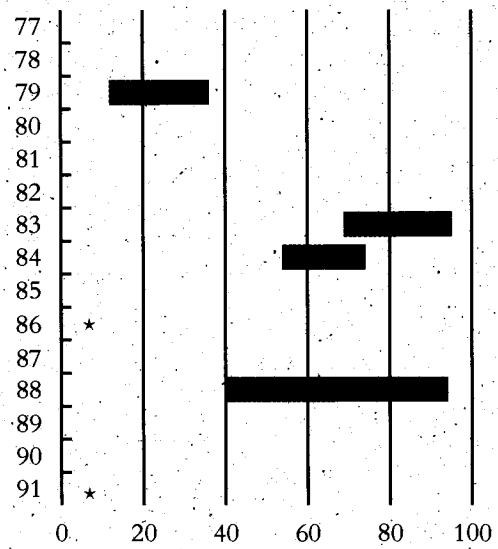


Figure 5: PCB concentrations in Y.O.Y. spottail shiners ($\mu\text{g/g}$), 1970s - 1990s

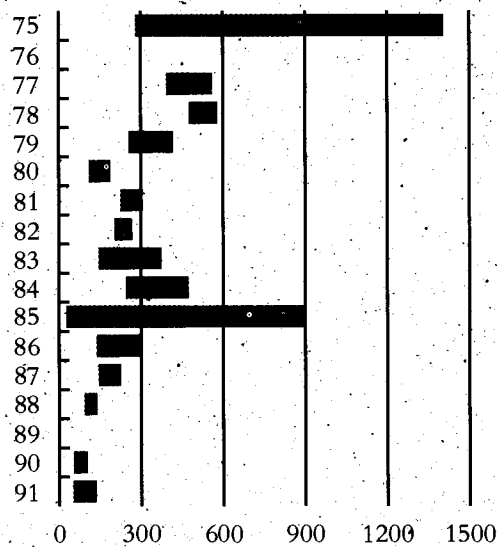
HUMBER RIVER



KAM RIVER



LEAMINGTON

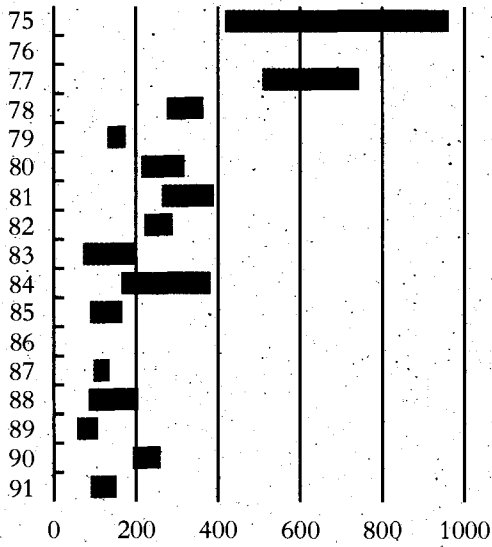


LEGEND

- MEAN +1 STANDARD DEVIATION
- MEAN
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- * NOT DETECTED
- * TRACE

Figure 5: Continued

NIAGARA-ON-THE-LAKE



PIKE CREEK

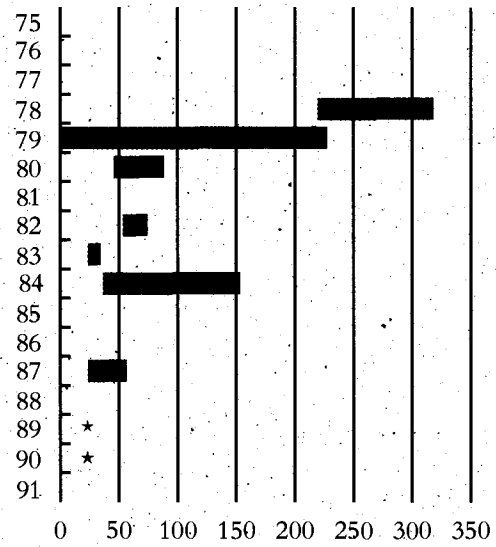
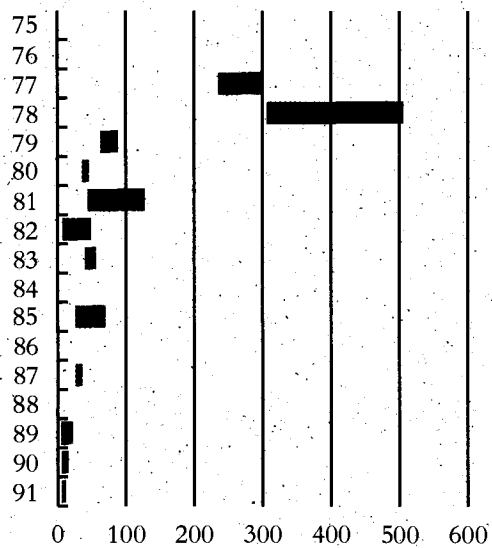


Figure 6: DDT concentrations in Y.O.Y. spottail shiners (µg/g), 1970s - 1990s

HUMBER RIVER



KAM RIVER

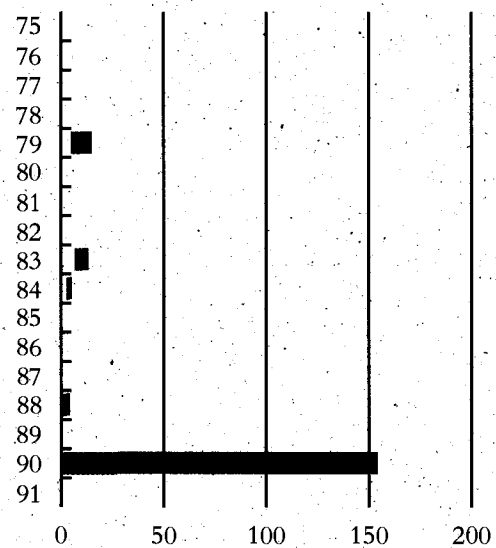
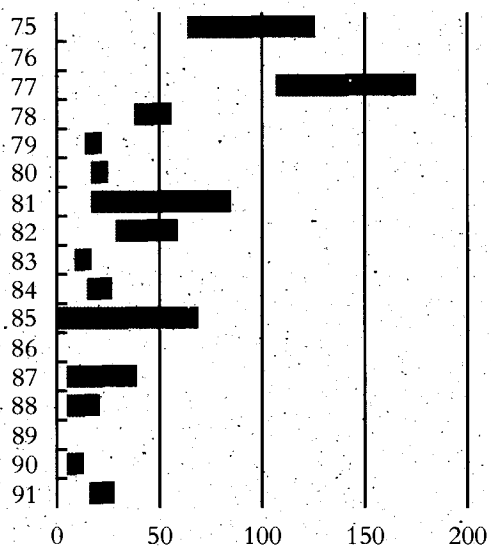
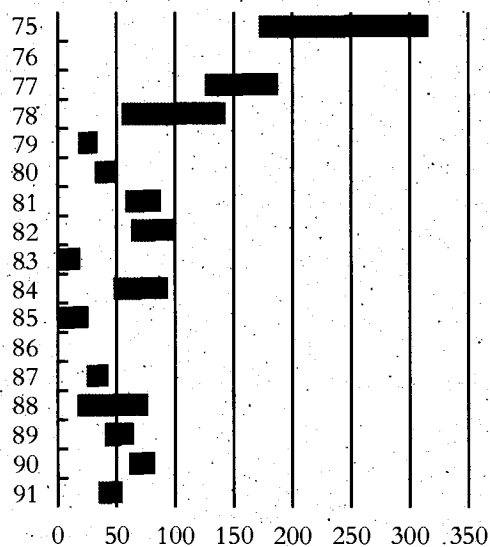


Figure 6: Continued

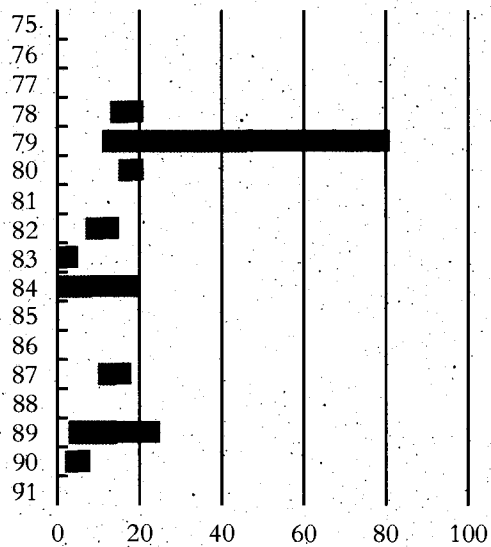
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NIAGARA-ON-THE-LAKE



PIKE CREEK

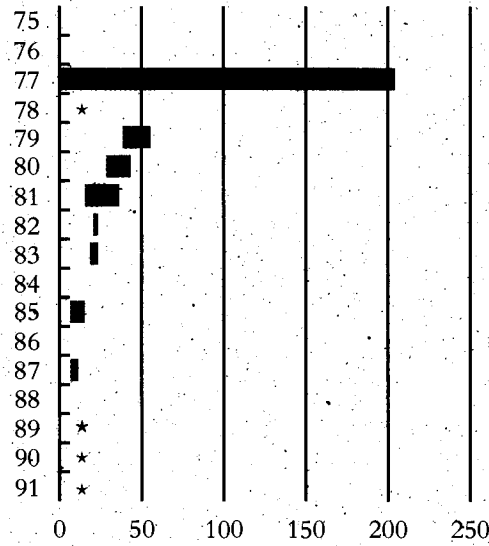


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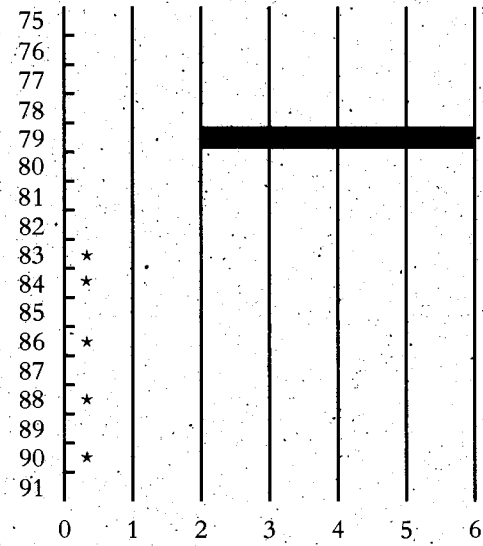
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Figure 7: Chlordane concentrations in Y.O:Y. spottail shiners ($\mu\text{g/g}$), 1970s - 1990s

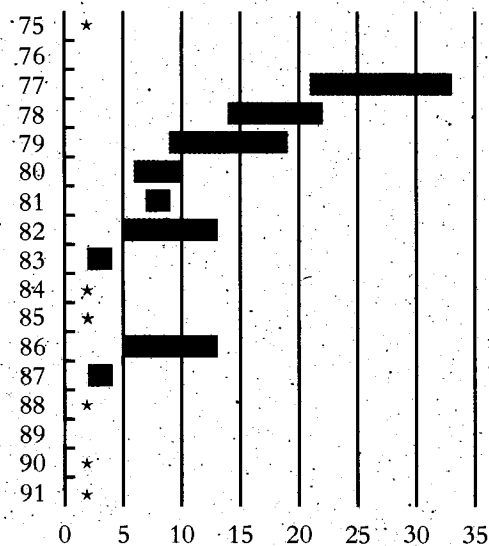
HUMBER RIVER



KAM RIVER



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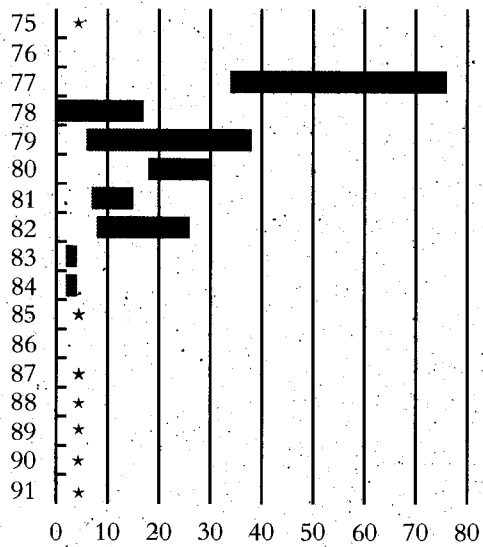


LEGEND

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Figure 7: Continued

NIAGARA-ON-THE-LAKE



PIKE CREEK

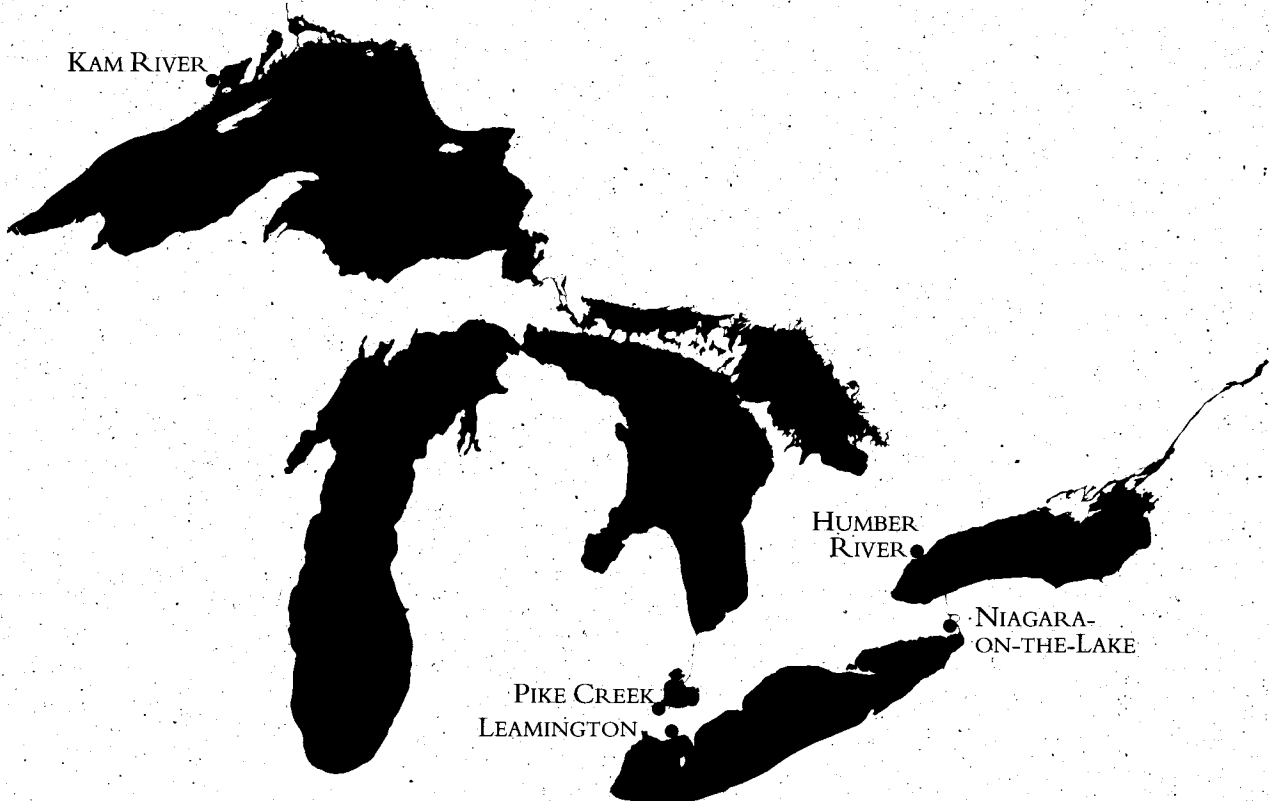
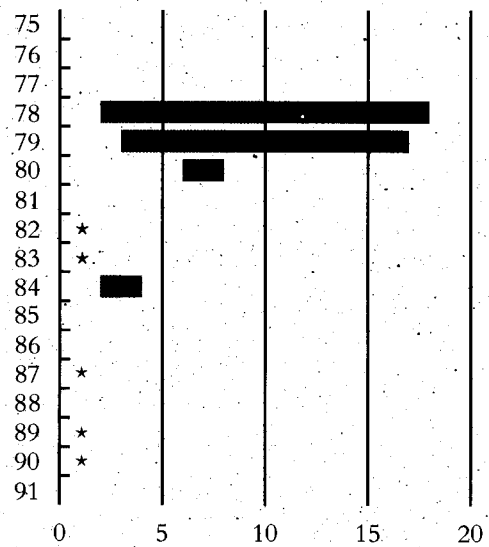


Figure 8: Spills of oil and chemicals to the Great Lakes system

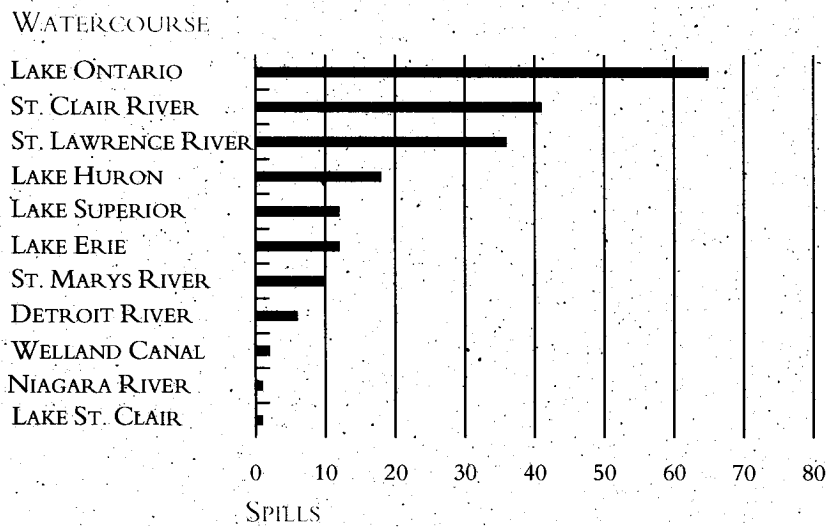


Figure 9: Spill volumes by material type, 1992

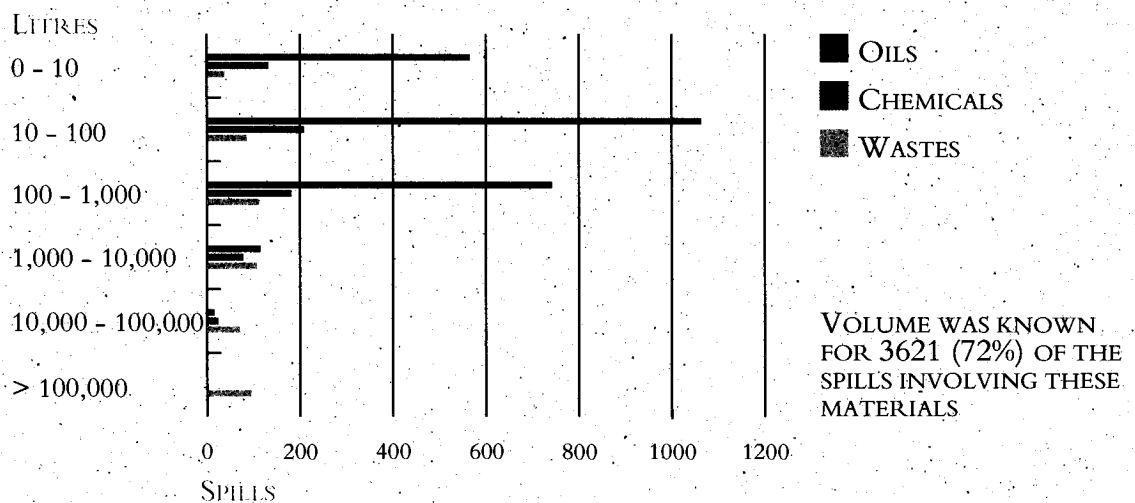


Figure 10: Land stewardship II program conservation equipment and structures

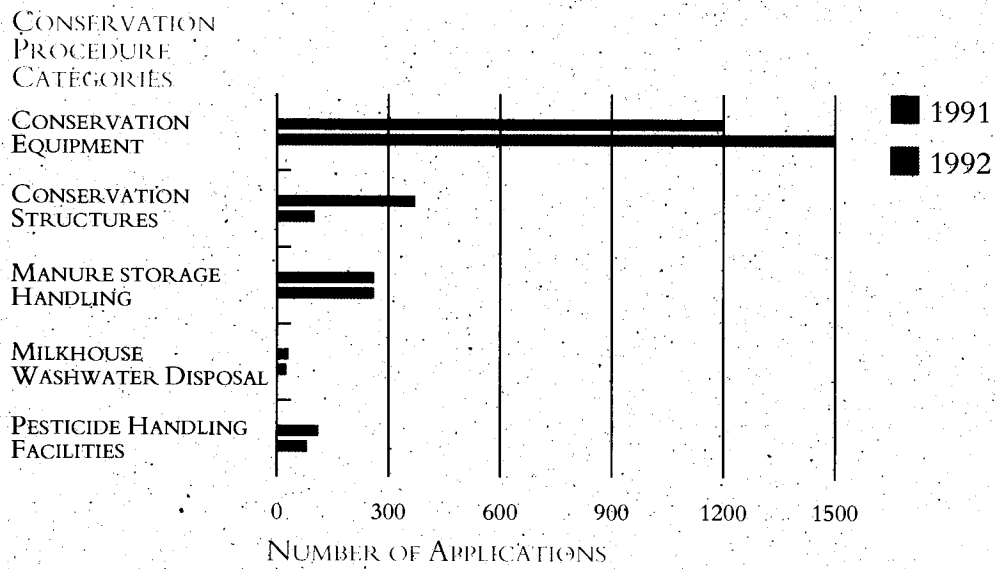


Figure 11: Land stewardship II program, conservation systems

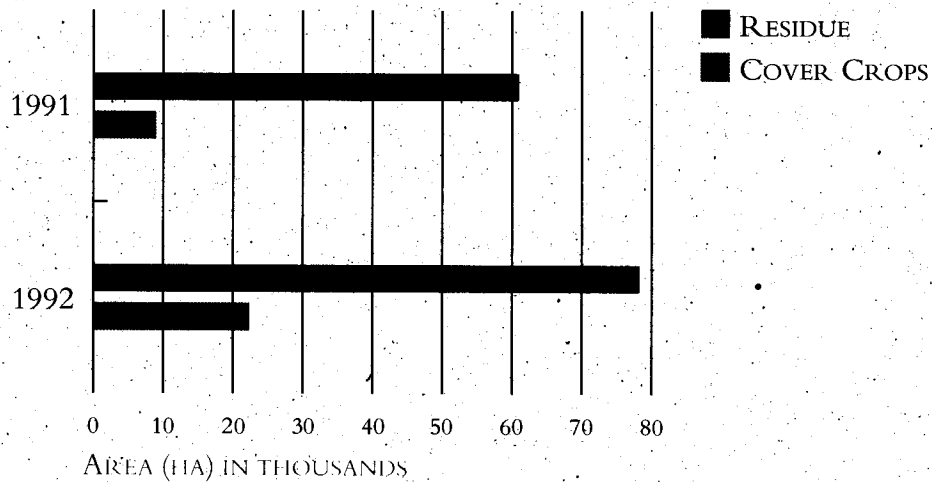


Figure 12: Ontario pesticide education program

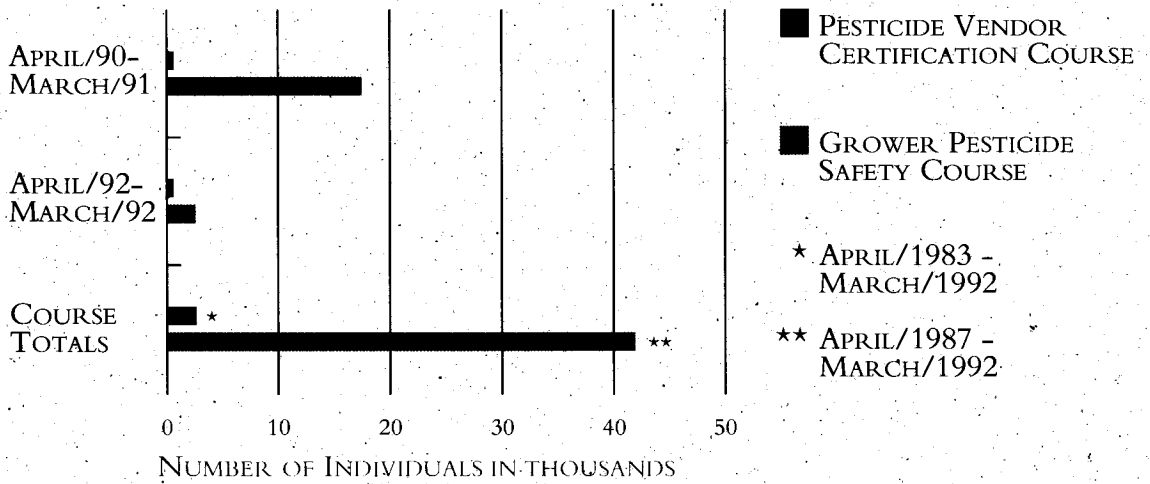


Figure 13: Integrated pest management program, 1991 growing season - May 1992

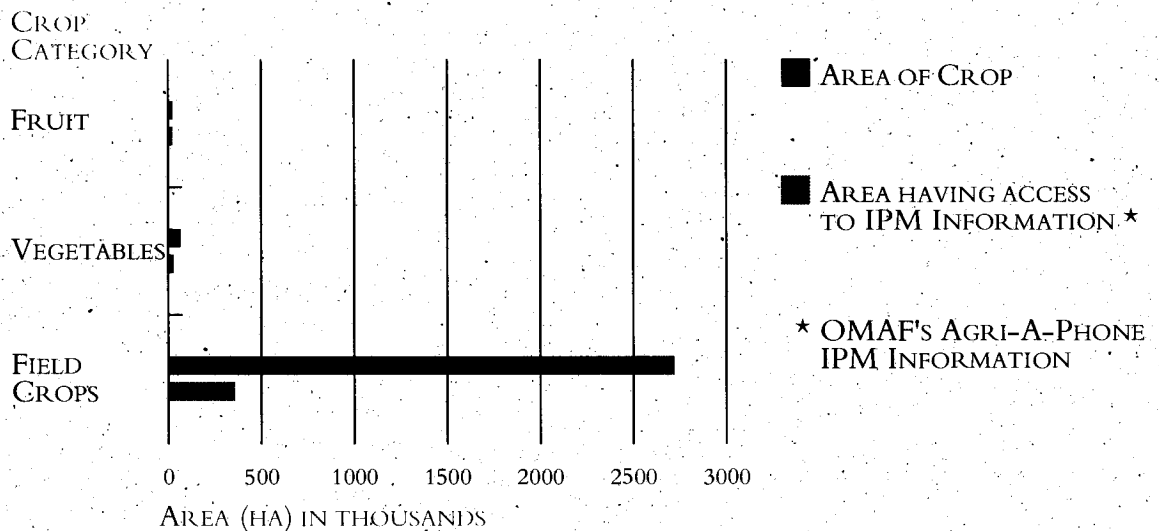


Figure 14: Sweep survey, land management practices

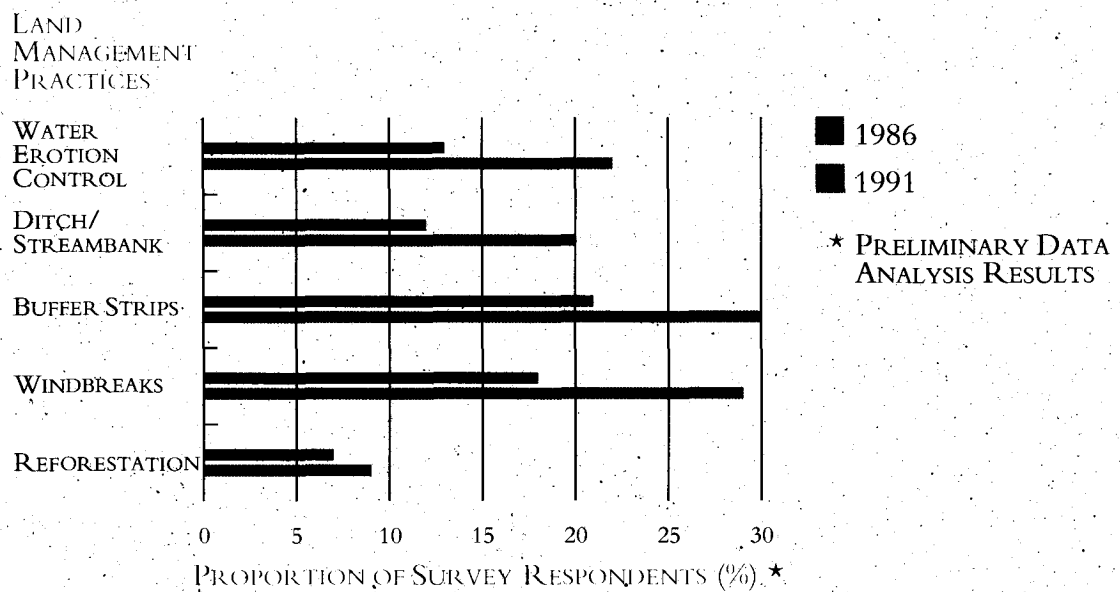


Figure 15: Zebra mussel distribution, December 1992

